FLIGHT

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and The AIRCRAFT ENGINEER

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OFFICIAL ORGAN OF THE ROYAL AERO CLUB DECEMBER 17th, 1942

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The REID & SIGRIST Trainer

BRITAIN'S STRENGTH IN THE SKIES

Britain's most formidable long range fighters have caused great destruction in Africa and the Mediterranean. Here "Bristol" Beaufighters are seen sinking Italian schooners by cannon fire.

FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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The Outlook

Transport Aircraft

THERE appears to be considerable support from our readers for the suggestion we made last week that a Parliamentary Committee should be set up to look into the question of post-war commercial aviation. Such a committee would obviously have a number of sub-committees whose special task would be to examine in more detail than could the main committee the many different problems that would arise—political, technical and financial.

The aspect with which *Flight* is mainly concerned is the technical, and this week we publish the first part of an article which reviews what has been done in the past. It is hoped that this may serve as a reminder of how far, so to speak, we had progressed when the war stopped development. The work of other nations, notably the United States of America, has had an opportunity to go on in spite of the war, and it is interesting to review what our great ally has been doing and intends to do. Technically, this will have considerable influence upon our own post-war design policy.

One thing emerges quite clearly already: We shall need more than one class of aircraft for our post-war commercial work. We visualise four, as it appears doubtful that a smaller number would provide efficient working on all routes. There will obviously need to be a specialised type for the Atlantic traffic; another for the Empire routes; a third for European services; and the fourth for our short internal routes. Within that classification, which we regard as a minimum, there is plenty of scope for designers; for the first route it is not even clear whether the answer is a flying boat or a landplane. Our personal inclination is towards the flying ship, but we are open to argument in favour of the landplane if it can be shown to be the more economical type from an operational point of view. We feel, however, that the huge commercial types of the future should logically be flying ships, which are not troubled by concentrated loads on runways, and which become more seaworthy the larger they grow.

Per Ardua ad Astra

DURING the last two years or so *Flight* has devoted much space to the subject of high-altitude flying and its associated problems of supercharging cabin and engine. We have always held the view that where but relatively small differences in speed exist between two fighters, for example, that which has the higher ceiling is at an advantage compared with the other, even if its speed is slightly lower. The dive available to the upper aircraft can readily be made to yield the necessary surplus of speed, and the very fact that the machine can climb higher than its adversary is an indication that its wing loading is likely to be lower, which is tantamount to saying that, granted that the two machines were designed with equal skill, it is likely to have better manœuvrability.

We have never underrated the difficulties, and we have done what we could to throw light on them by publishing all available material. Thus in our issues of January 15th and 22nd of this year, *Flight* contained an article by two German experts on the design of superchargers. Our issue of March 12th contained an article on the design of coolers for superchargers. This also was by a German author and, like the first article, had been translated from German sources to give our readers an idea of what the enemy is doing in this particular branch of aircraft engineering.

It is with very great satisfaction that we are now able to record in this issue the achievement of British engineers in getting into the air and thoroughly proving the first completely successful two-stage supercharger.

The Rolls-Royce company has been working on this problem for more than two years, and the results are now disclosed in the Merlin 61, which is, basically, the Merlin XX with two blowers in series. Already the engine has been very successfully demonstrated, and will take a Spitfire fighter over the 40,000ft. mark. Not only so, but at that height the machine still has sufficient manœuvrability to engage enemy aircraft and bring them down.

The Rolls-Royce two-stage blower is of the mechanically driven type, and the fact that the two impellors are mounted on the same shaft and run at the same speed has enabled the single-stage drive of the Merlin XX to be retained almost without modifications except for changes in gear ratios and the strengthening of a few parts.

The main problem which the two stages introduced was that of cooling the charge. Our article of March 12th dealt with difficulties of this nature, and the author, in examining the problem of where the cooler should be placed, came to the conclusion that the choice was no easy one, and was, as is usual in aircraft engineering, a compromise between conflicting requirements. The interstage cooler, he argued, would have to be of greater frontal area and, therefore, greater drag, since it was dealing with a charge the temperature of which was not very much above that of the cooling air. The end cooler, on the other hand, in spite of smaller frontal area and lower weight, required more power to drive the blower, owing to the fact that compression approaches the adiabatic type, while with an intermediate cooler isothermal compression is approached.

In the Merlin 61 the end cooler has been chosen, and, incidentally, we rather disagree with the adopted term "intercooler." The German word *Endkühler* (end or final cooler) seems more logical. Charge cooler is a description we favour, but even that may be somewhat ambiguous, since even an inter-stage cooler is also a charge cooler. Perhaps readers with ideas on the subject would like to send us some suggestions.

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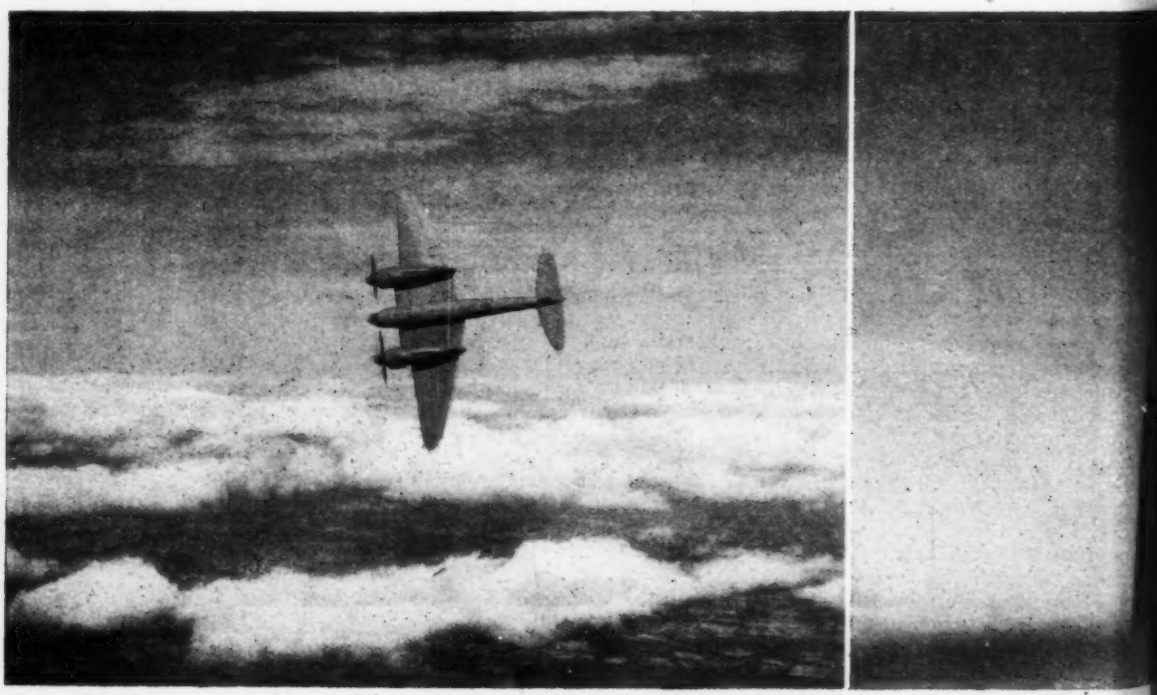
Mediterranean Bombers

IN a recent article in *Flight* it was urged that now was the time to mass heavy bombers in Northern Africa, and it appears that we shared that view with the Higher Command of the United Nations. The United States Ninth Air Force has now established its headquarters at Cairo, and British and Empire aircrews who had previously been flying Liberators have now been placed under its command—another example of that Anglo-American unity which is so promising. This Army Air Force has bombed the port of Naples by day and by night. Italy is now being hit from both North and South, and the outlook before that misguided (literally mis-guided) country is grim.

At the same time the ports in Tunisia and Tripolitania have been raided both by the bombers working with the Eighth Army and those under General Eisenhower. The bulk of the heavy equipment with which the Germans have been holding back the Anglo-American and French forces must have come in by steamers working at night, for air freighters could not have delivered more than a fraction of it



War in the Air

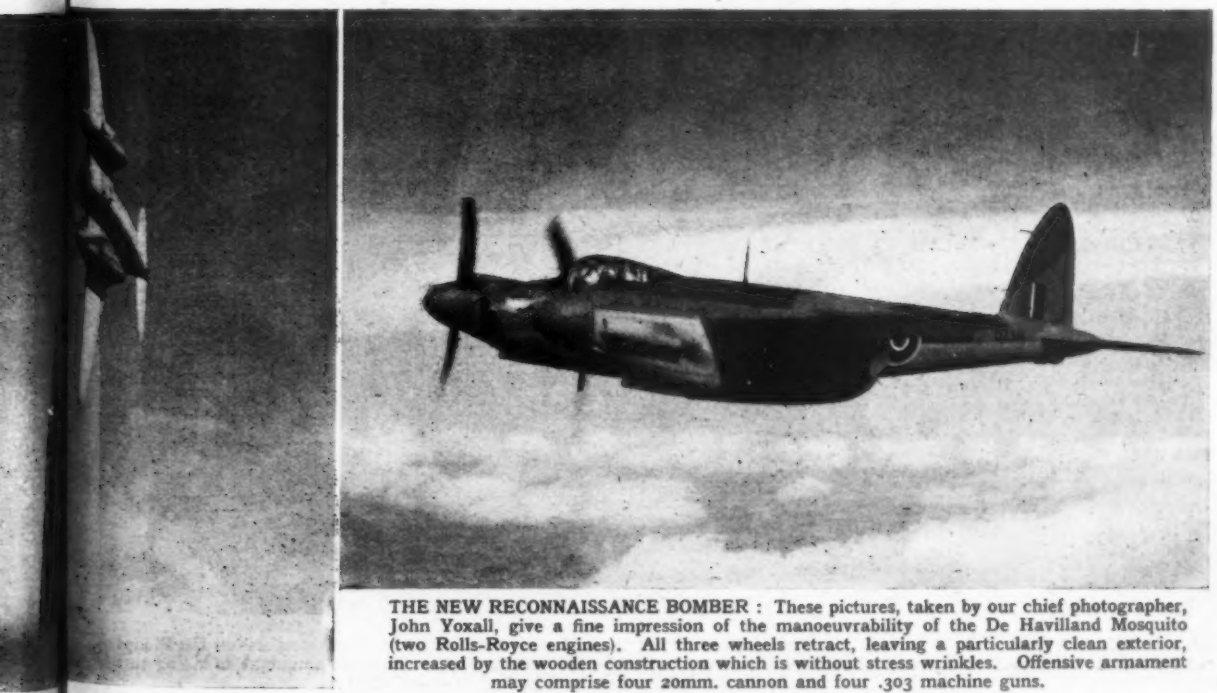
Transport Aircraft in Russia and Africa : Gona Taken by the Allies : Turin Heavily Bombed

GLIDER TROOPS IN TRAINING : Preparing to board the Horsa troop-carrying glider. Note the "camouflaged" faces.

TRANSPORT aircraft are very much in the news just now. The advances by the Russians on many sectors of their front have cut off German detachments in greater or less degree, and one statement issued in Berlin said: "Aircraft are now most important for transport; in several parts of the Russian front they are the sole possible means of reaching the German troops, and therefore air transport is being used to a greater extent than ever before." In addition this class of aircraft is in constant use between Sicily and Tunisia. On one day recently fighters from the Eighth Army found some 50 troop-carriers of the Ju 52 type flying back from Tunisia to Italy, with a fighter escort. The R.A.F. pilots shot down three Ju 52s and one Me 110, but it is a pity that so many of the troop-carriers got away. Next day about 30 more were found flying northwards, and R.A.F. two-engined fighters shot down two and damaged others without loss to themselves. The incidents give some idea of how difficult it is to cut a supply line which goes by air.

It has now been mentioned that in the fighting in Tunisia the Americans have been using their Curtiss Commando freighter, which carries 40 soldiers and is far faster than the Ju 52. A drawing and some description of this type were published in *Flight* of December 3rd. Reinforcements on both sides in Tunisia have taken the form of a race. The British First Army advanced rapidly, which was obviously the right thing to do, in the hope, no doubt, of seizing Bizerta and Tunis before the Axis could occupy those places in strength. The attempt was well worth while, but it did not succeed, and Gen. Anderson outran the possibilities of getting fighter cover during his advance. That seems to have been one reason for the British set-back at Tebourba. The First Army thereupon took up a strong position on the hills above the town and waited for reinforcements.

Other new types of aircraft have been mentioned for the first time as



THE NEW RECONNAISSANCE BOMBER : These pictures, taken by our chief photographer, John Yoxall, give a fine impression of the manoeuvrability of the De Havilland Mosquito (two Rolls-Royce engines). All three wheels retract, leaving a particularly clean exterior, increased by the wooden construction which is without stress wrinkles. Offensive armament may comprise four 20mm. cannon and four .303 machine guns.

WAR IN THE AIR

having been in action on this front, notably the Bristol Bisley, a development from the Blenheim which is a powerful close-support and reconnaissance aircraft, while over Europe the Lockheed Ventura, which is a development of the well-tried Hudson, has been used.

The Eighth Army in Cyrenaica has joined hands by air with the Anglo-American forces in French N.W. Africa, for the heavy bombers of the former have been raiding the docks and seaplane base at Bizerta, and also attacking the railway which joins Tunis and Gabes. The rainy season has started in Tunisia.

The Eighth Army seems to have been in the same condition as the First, namely, waiting in front of the Agheila position to build up its strength before making an attempt to storm Rommel's fortress. Coningham's aircraft, however, are still active on the German rear as well as the front, and fighter-bombers, presumably Kittyhawks and Hurricanes for the most part, have been out over the battle area.

Turin Bombed Again

ALL Italy is now part of the Mediterranean front, and the bombers which Air Chief Marshal Harris sends out from England to harry the ports and factories of Piedmont and Lombardy are part of the movement which in Africa is in the hands of Generals Alexander and Eisenhower.

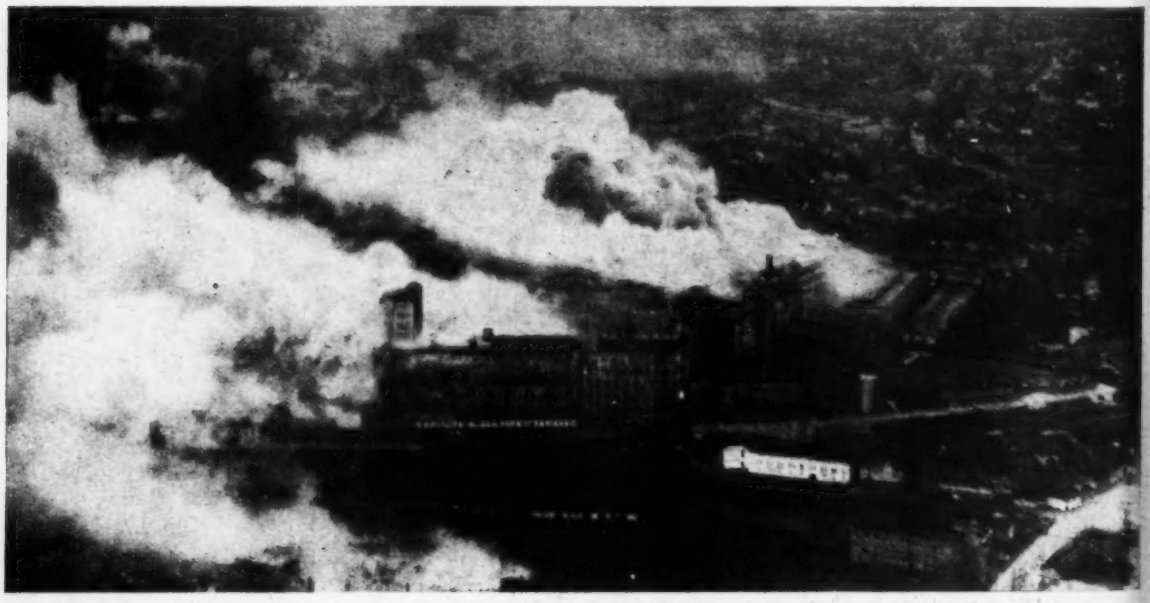
The factories of Turin have come in for devastating blows. This city on the river Po, only 40 miles from the French border, has a population of 654,000 and is the second largest town in North Italy. It is chiefly known as the home of the Fiat group of factories, which make aircraft engines, and many other articles. Other important works are the Lancia, which make lorries and tractors, the Snia Viscosa (textile fibres), and the chemical works of Montecatini. It is a place of obviously great value to the Axis, especially now that the Mediterranean front has become of major importance, and to put these works out of action is a great contribution by Bomber Command to the easing of the task of the Allied armies in Africa.

The destruction wrought has undoubtedly been very great. Bombs of 8,000 lb. and many of 4,000 lb. have been dropped on the factories, as well as innumerable fire-bombs. The glow of the flames in Turin has been seen lighting up the snows of the Alps as the R.A.F. bombers wended their way homewards. After the first raid Mussolini promised Turin strong defences by guns and searchlights, but they were not prompt in arriving, and on later raids the R.A.F. air crews were surprised by the weakness of the defence. The losses of Bomber Command were correspondingly light.

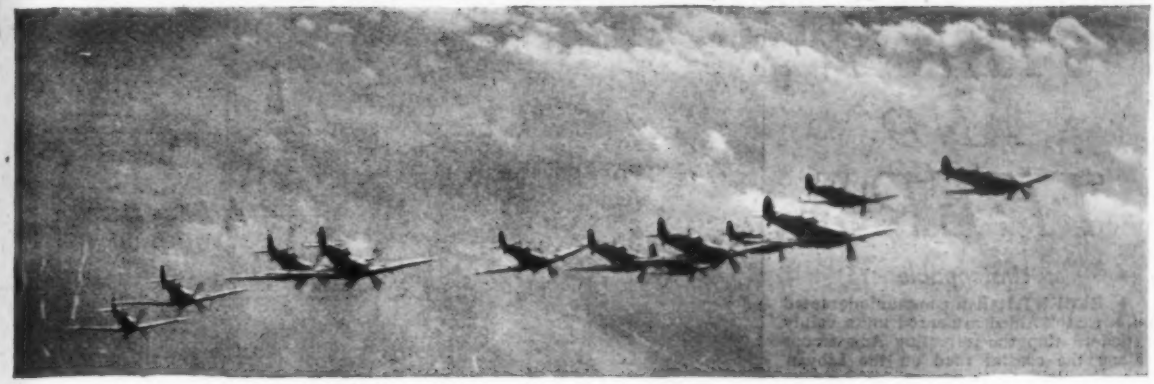
Further East

THE elimination of the Japanese party on the beach round Gona in New Guinea gives everybody great satisfaction. We had been told that the enemy was evidently resolved to fight to the last man, and it would seem that he did so, for the reports make no mention of a surrender. It also appears that in the later stages of the fighting the Japanese were short of aircraft, and their positions on the beaches were relentlessly pounded by Australian and American bombers and fighters. Attempts to land reinforcements were driven off by Allied bombers, with loss to the enemy. The Australians who have fought so grandly in taking Gona will now be free to help the American troops in polishing off the other position at Buna.

ON THE WAY HOME : Field Marshal Smuts visited the Libyan battlefields on his journey back to South Africa. He is seen here passing the tail of a wrecked Junkers Ju 52.



RADIO DISLOCATION : A remarkable photograph taken during the raid by nearly 100 of our light bombers on the Philips radio works at Eindhoven in Holland. Lockheed Venturas appeared for the first time in an official communiqué as taking part in this attack. **(Picture on page 670).**



FLIGHTS ASTERN : A formation of twelve "improved" Spitfires above the clouds. These are powered by the new Rolls-Royce Merlin 61 engine which has a two-stage, two-speed supercharger.

WAR IN THE AIR

Since the above was written Rommel has started to retreat from his position at El Agheila, and further developments are likely to take place immediately.

Mention has been made before of the way in which the Axis massed its U-boats in an attempt to interfere with the Allied landings in French Africa, and how this resulted in giving plenty of targets to British hunters of the under-water craft. It now appears that in a fortnight one R.A.F. squadron made nearly 40 attacks on U-boats. Naval craft would also make many more, often working on information sent by the aircraft.

Fortresses and Liberators of the Ninth American Air Force, which has its H.Q. in Cairo, have raided Naples by day and by night, and Bomber Command continued to bomb Turin.

Spitfires have now made their appearance in Tunisia, but at the time of writing they had to work from airfields rather far behind the front. The Axis was wise in seizing as many airfields as possible with the smallest delay, and this has hampered the British and Americans.

Col. Raff's parachute troops have been doing useful work in the southern area of Tunisia. If Rommel intends, or hopes, to fall back on the Axis forces there he will find some stout fighters in the way. French units have been working with Col. Raff, and he is supported by the U.S. Twelfth Air Force. Parachute troops, of course, could not hold back armoured forces, but Allied armour may well arrive there before there is any danger from the East.

The Russian Front

FOR some weeks past there has been little mention of the work of the aircraft on the Russian front, except for the statement that the Germans were using transport machines to supply and reinforce various parties of their men who had been more or less surrounded by the Russian advances. Last year this expedient proved very successful in the case of the German force at Starya Russa, whose position at one time appeared hopeless.

At the end of last week, however, the Russian communiqués paid some attention to the air. They stated that in the Stalingrad area during the period November 19th to December 11th, Russian troops captured 105 German aircraft, in addition to much other equipment. This suggests sudden overrunning of a number of German airfields. It was also stated that in the same period Russian troops destroyed 632 aircraft, including 353 transport machines. Another official report says that in the week ending December 12th, 407 German aircraft, including 225 transport machines, were destroyed by fighters, by A.A. fire, or on the ground. The Russians only admit to losing 156 machines themselves during that week. Naturally, the Russian fighters would not run much risk when attacking transport machines.

In the West during November, Spitfires and Mustangs have attacked and hit no fewer than 42 railway engines, besides other targets connected with railways.

Daylight raids by Bomber Command must be keeping the *Luftwaffe* in Northern France in a constant state of guessing. The daylight raid by light bombers on the Philips wireless valve works at Eindhoven, about 60 miles from the Dutch coast, is the subject of one of our illustrations.

ENEMY AIR LOSSES TO DEC. 12th

		Over G.B.	Over Continent	Middle East
Dec.	6	0	4	2
,,	7	1	0	4
,,	8	0	0	13
,,	9	0	2	3
,,	10	1	0	5
,,	11	1	0	16
,,	12	0	6	2
		3	12	45

Totals : West, 6,509 ; Middle East and French Africa, over 5,099.

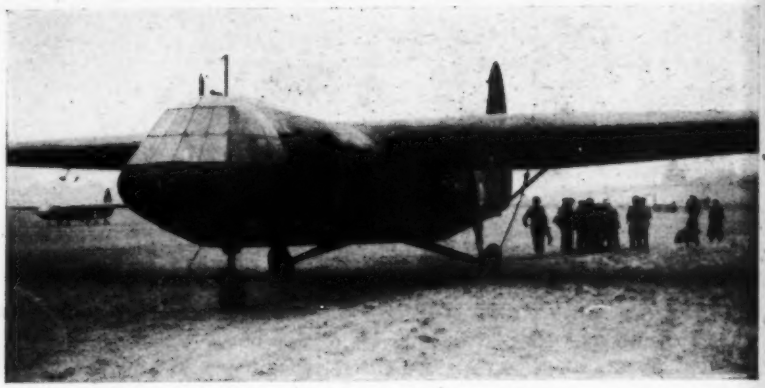
THE WORLD'S FASTEST BOMBER : De Havilland Mosquitoes of Bomber Command taxi into position for take-off. They each carry a bomb load of 2,000 lb.

BRITISH & U.S. AIR LOSSES TO DEC. 12th

		Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Dec.	6	0	21	3	2
,,	7	0	0	6	0
,,	8	0	2	0	2
,,	9	0	3	0	1
,,	10	0	0	2	4
,,	11	0	3	0	4
,,	12	0	0	5	0
		0	29	16	13

Totals : West, 4,948; Middle East and French Africa, about 1,973.

HERE AND THERE



TROOP-CARRYING GLIDER : Although the study of parachute and glider-borne troops did not begin in this country until after the present war began, no time has been lost in making up the leeway, and this is an example of one of the latest troop-carrying gliders developed by Great Britain—the *Horsa*.

Unstoppable

A RECENT Italian communique stated that "Allied armoured units vainly tried to stop the retreating Axis troops along the coastal road on the Libyan frontier."

Axis soldiers may now be expected to boast how they "made the Allies run" in Libya!

Shannon Airport Manager

THE Eire Minister for Industry and Commerce (Mr. Sean Lemass) has appointed Colonel P. Maher temporarily to the post of Airport Manager at the Shannon Airport, County Clare.

Colonel Maher is a Director of Artillery in the Eire Army, and has been associated with the Artillery Corps since its formation in 1924. He is a native of Tipperary and received his promotion to the rank of Colonel last year.

Quid Pro Quo

AMERICAN squadrons attached to Coastal Command, forming part of the Command's reinforcements for the protection of the North African invasion convoys, have a particular interest in common with a British squadron stationed at an adjoining airfield; they all fly Liberators.

When the aircrews meet, which is fairly often, they invariably talk a particularly useful brand of "shop," for the British airmen can give Americans the benefit of three years' accumulated experience in their specific duties, while Uncle Sam's boys contribute to the common fund of knowledge by passing on hints and tips about the handling of Liberators and their American engines.

As one British pilot expressed it, "These chats are worth dozens of flying hours."

"Lark Squadron"

"L'ESCADRILLE des Alouettes" is the name now adopted for the French-Canadian bomber squadron operating from a British base.

It means "Lark Squadron," and was suggested by Fulgence Charpentier, the Press censor in Ottawa, who pointed out that not only is the lark the tribal emblem of the Gauls—direct ancestors of the French Canadians—but it is a bird which flies high and never perches on trees.

"Flight" photograph.

A SPITFIRE'S MUFFLER : To combat cold weather starting troubles at the open-air dispersal points, the Roll-Royce Merlin 61s are enclosed in fabric, which has a vertical trunk in which a stove can be placed to keep the engine warm. Muffs are placed in the mouths of the radiators to retain the heat, but these muffs and air covers are all connected together so that it is impossible to remove the engine covering without taking out the radiator muffs.

Single Rotor Blades for Giros

TWO pairs of long lifting blades rotating in opposite directions on one shaft are too many for an autogiro or a helicopter, according to Gage W. Tidd, of Willow Grove, Pennsylvania, who evidently is an engineer of the Autogiro Co. of America (located in the same city) and to which he has assigned a patent (No. 2,297,815) issued to him in October.

The patent covers the inventor's conception of a pair of single blades mounted on concentric shafts and oppositely rotatable, each blade counterweighted on the opposite side of its shaft to counteract the centrifugal force of the horizontally rotating blade.

Air resistance to rotation of the long blade and the small, close-in counterweight differs greatly, however, and if the centre of gravity of the two is made to coincide with the axis of the shaft, unequal forces are created which rock the shaft and set up vibration in the engine. Therefore, the counterweight is offset a little from the axis of the blade or a second counterweight is placed at a distance of 90 degrees around the shaft from the first one.

If the counterweight or weights are adjusted correctly to equalise the centrifugal forces, the rotor will revolve without unbalance.

"Show a Leg!"

GOODNESS knows what the veterans with Great War No. 1 ribbons think about it, but in an R.A.F. training station in the north of England the aircrew cadets are not awakened at the crack of dawn by the traditional notes of a bugle sounding the Reveille; they are entreated to "show a leg" by the voice of the camp's radio announcer.

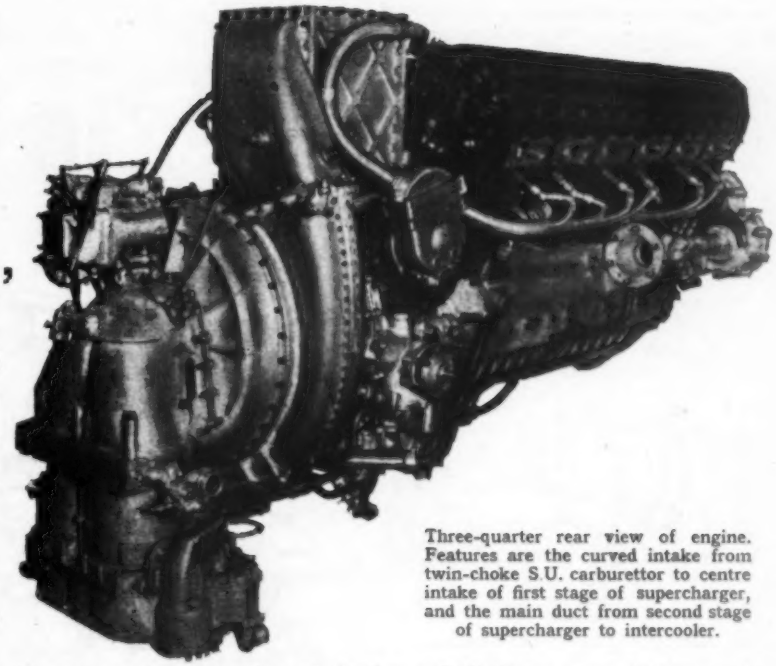
This particular station is extremely up to date in its radio-consciousness, for it has its own internal broadcasting system which gives forth three daily broadcasts containing instruction, entertainment and news, and ranging from talks on aircraft recognition to sessions by the station's own dance band and "domestic" news items—the dance band is a great favourite, needless to say!

The novelty of the system has been found greatly to stimulate interest in the corporate life of the station and in R.A.F. matters generally.

ROLLS-ROYCE MERLIN "SIXTY-ONE"

NOTABLE BRITISH ENGINE PROGRESS: TWO-STAGE, TWO-SPEED SUPERCHARGER ENABLING STRATOSPHERE FLIGHT

By G. GEOFFREY SMITH, M.B.E.



Three-quarter rear view of engine. Features are the curved intake from twin-choke S.U. carburettor to centre intake of first stage of supercharger, and the main duct from second stage of supercharger to intercooler.

PROGRESS in the design of superchargers, particularly during the last three years, is responsible for aircraft engines of a given size developing far greater power at high altitudes. British technical achievement in this field is of the greatest importance in maintaining ascendancy over the enemy, and Rolls-Royce engineers are to be congratulated upon the introduction into service types of the first proved type of two-stage two-speed supercharger. It is on operational duties in the Spitfire, and bears the type number "61."

A month ago the existence of a new Spitfire fitted with the new type 61 Merlin engine was revealed, and brief details appeared in *Flight* of November 19th. This new Spitfire, which has two cannon and four machine guns, has already achieved striking successes in the air both over the Channel and in the Middle East theatre of war. One outstanding achievement was the destruction at a height of over 40,000ft. of three of Germany's stratosphere reconnaissance aircraft, type Ju 86P, which is reputed to have a pressure cabin, diesel engines and exhaust turbo superchargers.

Since the heart of any good aircraft, be it fighter or bomber, is the engine, details now released for publication of the latest Rolls-Royce contribution to the many notable technical achievements of this world-renowned firm are of particular interest. The "sixty-one" engine is a development of the twelve-cylinder V-type liquid-cooled Merlin, the perfection of which engine before the outbreak of war has meant so much to this country.

The cylinder dimensions of 5.4in. bore by 6in. stroke, giving a capacity of 1,649 cubic inches, or 27 litres, remain the same; compression ratio is 6 to 1, but thanks to the development of a two-speed two-stage supercharger and an improved larger S.U. twin-choke carburettor, designed as a complete separate unit, the power output has been greatly increased, and the engine is capable of maintaining its exceptional performance over a far greater range than hitherto. Operational altitudes with the Spitfire-Merlin 61 combination in conjunction with a four-blade airscrew to absorb the greater power output are now in excess of 40,000ft. Daily paper talk of air combats in the Battle of Britain at 40,000ft. was much exaggerated.

Long years of experiment were necessary to bring the multi-stage supercharger and its necessary intercool-

Three-quarter view of the improved Spitfire fitted with the R.-R. Merlin 61 engine and Rotol four-blade airscrew.

LEADING PARTICULARS

ROLLS-ROYCE MERLIN "61"

NUMBER OF CYLINDERS	12
BORE AND STROKE	5.40" × 6.00".
VALVES—2 INLET 2 EXHAUST	per cylinder operated by overhead camshafts via rockers.
COOLING MEDIUM	Pressure water (30% glycol.)
COMPRESSION RATIO	6.0 : 1.
SUPERCHARGER ...	Two-speed two-stage with intercooler.
CARBURETTOR ...	S.U. twin-choke updraught.
TOTAL CAPACITY ...	1,649 cu. ins. or 27 litres.
REDUCTION GEAR ...	Direct spur
RATIO	.42 : 1
DIRECTION OF ROTATION ...	Airscrew—right-hand Engine—left-hand
ESTIMATED NET DRY WEIGHT ...	1,600 lb. + 2½%.

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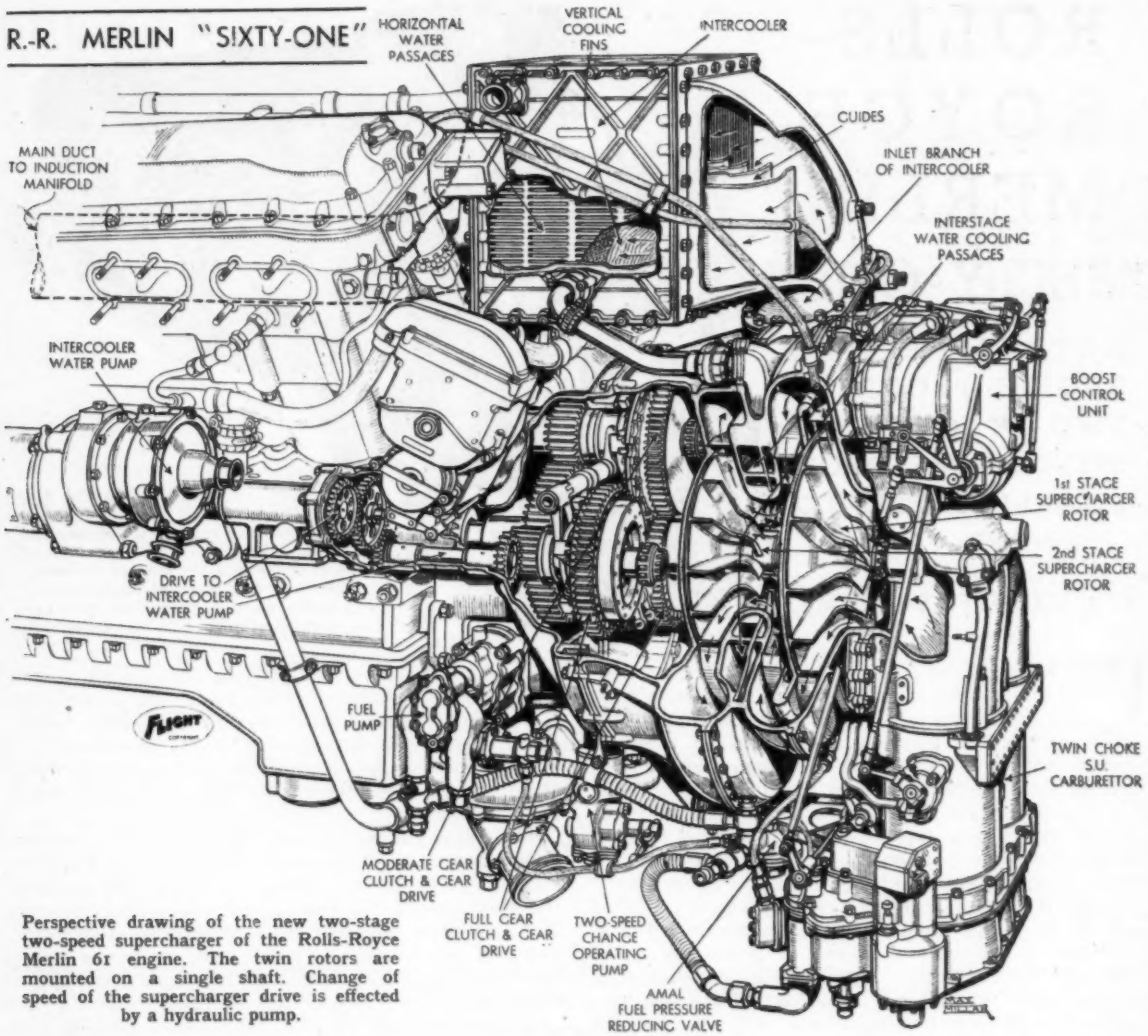


Perspective drawing of the new two-stage two-speed supercharger of the Rolls-Royce Merlin 61 engine. The twin rotors are mounted on a single shaft. Change of speed of the supercharger drive is effected by a hydraulic pump.

ing mechanism to its present state of perfection, whilst hand in hand the process of extracting more and more power from the Merlin has gone on continuously. For example, the XX engine to-day produces 250 h.p. more than the III of identical cylinder dimensions.

From single-speed superchargers with a rotor running at the tremendously high speed of 28,000 r.p.m., i.e., approximately nine times engine speed, the demand for more power at a high ceiling led to the fitting of two-speed mechanism, as in the Merlin XX. For a given boost pressure, both at take-off and low altitude, a considerable improvement in power output is obtained when using the lower gear, and for altitude work the higher gear is brought into use. On the "full" or high gear this engine develops 1,175 b.h.p. at 2,850 r.p.m. + 9lb./sq. in. boost at 17,500 ft. altitude using 100 octane fuel.

Meritorious Progress

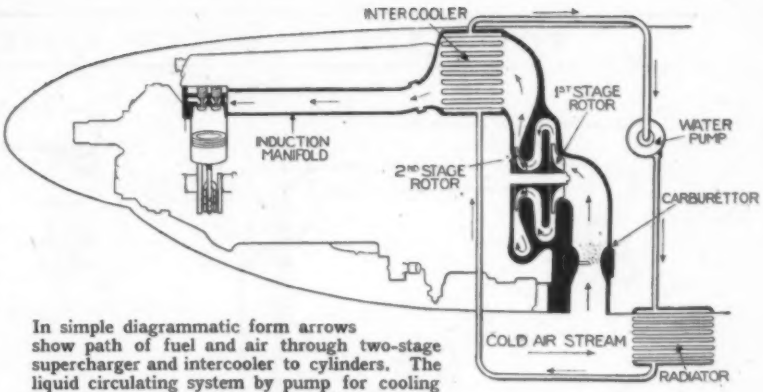
Later, in the search for higher boost pressure, the two-stage supercharger in conjunction with a two-speed gear was patiently progressed through the research and experimental stages, so that to-day we have to thank Rolls-Royce engineers for the ability to fly aircraft at altitudes in a region some eight miles above the earth's surface. Such altitudes involve special protective measures for the safety and comfort of the pilot.

We owe it to British technicians to acknowledge the highly meritorious technical progress in not only extracting more power from the Merlin but at the same time attaining that ideal without radical changes being necessary to install it in our modern fighters. Dimensionally the "61" is slightly longer overall than the Merlin XX because of the intercooler located immediately aft of the cylinders. It scales approximately 1,600 lb. compared to the 1,450 lb. of the Merlin XX. The only important change in design is the adoption of a two-piece cylinder similar to that designed by Rolls-Royce for the Merlin XX produced by the Packard Co. Thus the flow of Spitfire and Hurricane fighters from British factories has not been adversely affected by the modifications which gave us the 45 and the XX engines, and now the 61.

It will be helpful to recapitulate briefly and simply the object of feeding mixture into an engine by pressure. The work of a supercharger or blower is to force a certain weight of air into the engine, and *en route* to mix it with a certain weight of fuel. In a normal car engine the charge of petrol and air is induced by the downward stroke of the piston, but in the case of a supercharged

aircraft engine the mixture is forced into the cylinders under pressure (technically known as boost pressure), created by a centrifugal blower. Thereby the engine is enabled to consume a greater weight of charge and to develop a greater horsepower. *Weight* of charge in the cylinders is the important aim, not the *volume*, since the volume varies with the pressure.

At sea level the weight of air is 0.076 lb./cu. ft. at 59° F., and at 20,000ft. altitude it is 0.046 lb./cu. ft. Thus, with a normal engine around this altitude the volumetric efficiency falls appreciably, since each cylinder is receiving only about half-weight charge. At 35,000ft. the air density is roughly a quarter of the figure at sea level.



In simple diagrammatic form arrows show path of fuel and air through two-stage supercharger and intercooler to cylinders. The liquid circulating system by pump for cooling the mixture is entirely independent of the liquid cooling for the cylinder jackets.

Restoring Boost Pressure

Clearly then, the object of employing a two-speed drive for the supercharger is to speed-up the impellor of the supercharger after a certain altitude has been attained, and so force into the engine a greater volume of the less dense air to supply the necessary weight of charge to sustain power at still greater altitudes.

The two-stage supercharger, with its independent intercooler, carries on the same process in higher altitudes, in precisely the same manner, but without recourse to correspondingly increased impellor speeds, to which there is a safe limit. Its beneficial effects thus become particularly important when the limit ceiling with a single-stage supercharger on "full" gear has been attained.

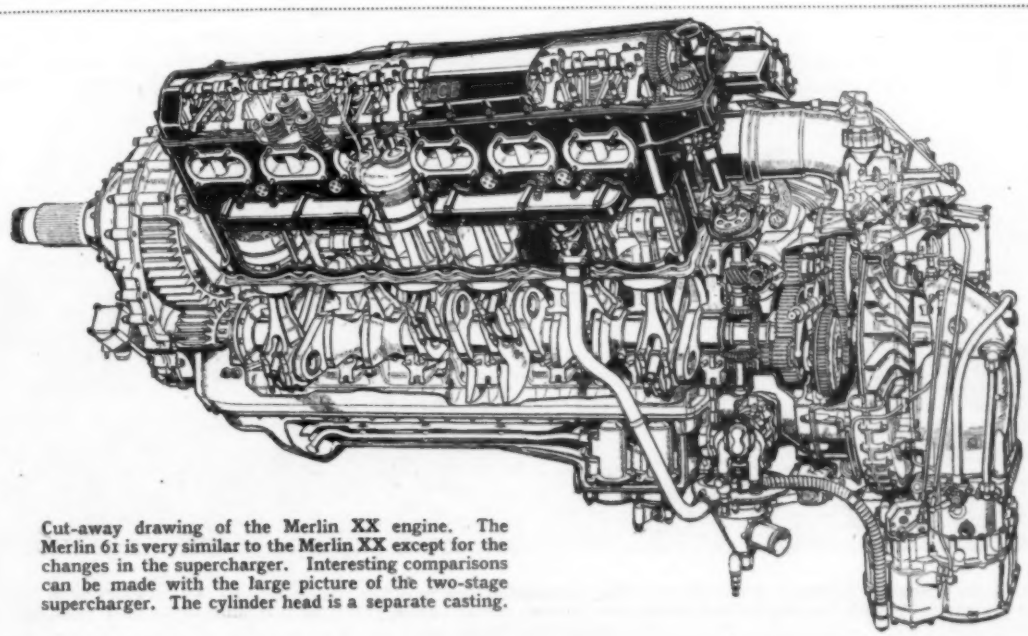
In the combination of a supercharger with two rotors (or stages) driven by mechanism providing two different gear ratios, the Rolls-Royce achievement is highly progressive, and its advent marks a new era in aircraft engine performance. By its use it is possible so to increase boost pressure that the maximum power developed at sea level is maintained at much higher predetermined altitudes than formerly.

Having examined the objects and advantages of multi-stage blowers, we may turn to the details and illustrations.

Twin Superchargers in Series

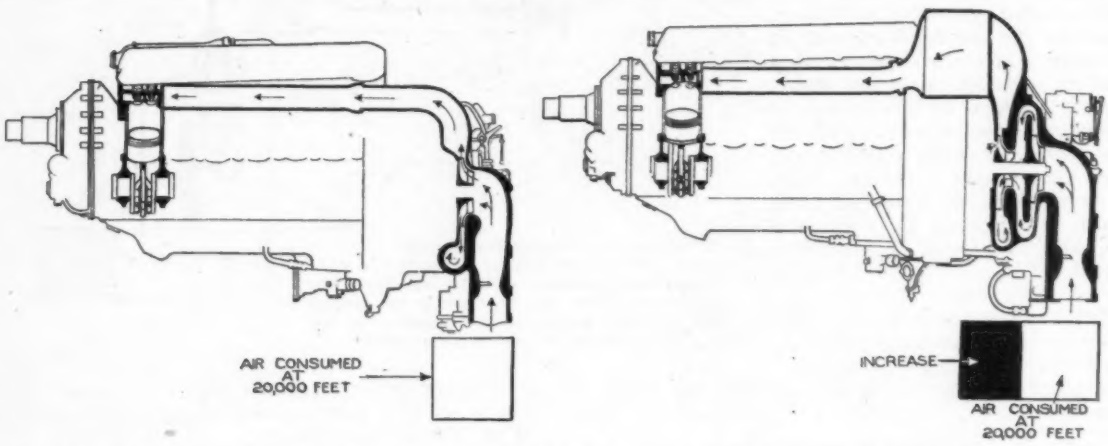
The two-stage supercharger has two rotors on a common shaft, and in effect constitutes two separate superchargers in series. The mixture of air and petrol which is drawn through the carburettor is compressed by the first-stage supercharger, and is then delivered to the inlet of the second-stage supercharger, which is of smaller diameter than the first, where it is still further compressed before being finally delivered to the induction manifold.

The power expended in compressing the large quantity of air required for combustion of the fuel would normally result in considerable heating of the mixture. To reduce the mixture temperature to a normal figure a means of charge cooling or intercooling is introduced. This process of compression inevitably carries with it heating



Cut-away drawing of the Merlin XX engine. The Merlin 61 is very similar to the Merlin XX except for the changes in the supercharger. Interesting comparisons can be made with the large picture of the two-stage supercharger. The cylinder head is a separate casting.

ROLLS-ROYCE MERLIN "SIXTY-ONE"



Diagrams which explain single-stage and two-stage supercharging. The squares indicate diagrammatically the volumetric increase of air achieved by two-stage supercharging over the single-stage. Increase in air volume allows of corresponding increase of charge, with proportionate increase in power.

of the charge. The higher the pressure to which the air is compressed the greater will be its final temperature, and that result is a disadvantage as expansion occurs with heat and the weight of the volume of the charge which can enter the cylinder correspondingly reduced.

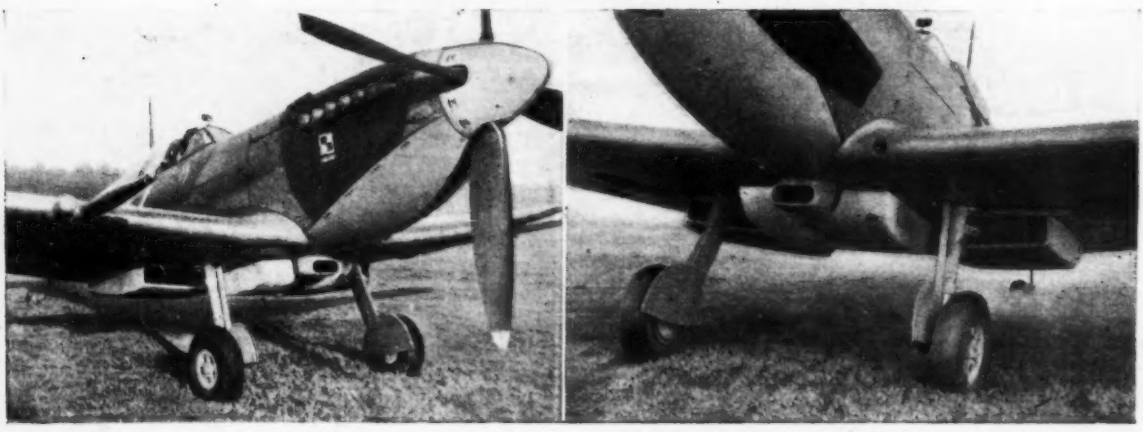
A simple illustration of heating by compression is a bicycle tyre inflator which gets unbearably hot to the hand by continuous strokes of the pump. This is what happens to the charge when highly compressed by the supercharger; hence the necessity for the intercooler is to prevent undue expansion by keeping the charge cool and so ensure maximum weight per unit volume.

Cooling the Charge

The way in which this intercooling is carried out is very ingenious. A square, box-like structure is mounted in the induction system between the outlet of the second-stage supercharger and the rear of the cylinder blocks. This box contains a stack of horizontal tubes through which water is circulated by a special pump. The hot charge from the outlet of the supercharger is passed, on its way to the main induction pipe, around and between the tubes of this heat exchanger, and in this region of artificial cooling its temperature is considerably reduced.

In addition to the means of cooling the charge by the intercooler, there is also an inter-stage cooling system comprising water passages in the supercharger casing between the two rotors. The intercooler, or charge-cooling system, is entirely separate from the main cooling system for the cylinder jackets, and one of the outstanding advantages of this novel method is that the actual radiator which cools the circulating liquid of the intercooler, and from which the excess charge temperature is dissipated to the atmosphere, may be placed in any convenient position on the power plant or the aircraft.

In the case of the improved Spitfire, it is neatly housed under the wing in a duct which also contains one of the main engine cooling radiators. The engine cooling radiator proper is also underslung in a similar duct on the opposite wing, so giving a well-balanced, workman-



Britain's latest fighter—the stratosphere Spitfire. The main cooling system of the engine has two radiators located in housings below the wings. In each housing is also a small extra radiator, one for cooling the liquid circulating in the intercooler, the other for cooling the engine oil.

R.-R. MERLIN "SIXTY-ONE"

like effect. This second duct embodies the engine oil cooler as an integral unit.

A further advantage of the liquid-cooled intercooler is that it can be made considerably smaller than would be the case if the heat interchange was made direct to the atmosphere. Since it is important that the intercooler should be mounted in such a position that the induction system is kept as short as possible, limitations of space and the need for a good view for the pilot would probably mean that a sacrifice in intercooling efficiency would have to be made if direct air-cooling of the charge was employed.

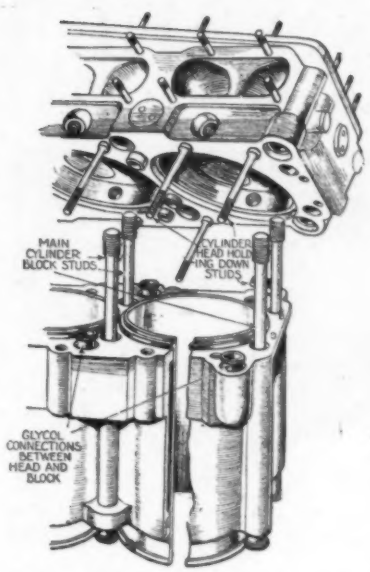
No structural alterations

The successful application of this complex system to a Merlin engine so that the combination could still be installed in existing Spitfire aircraft was in itself a praiseworthy accomplishment. Briefly, it entailed a slightly longer nose.

Comparing engines powering the various first-line aircraft, German engines are fitted with a single-stage supercharger driven by a hydraulic coupling and capable of maintaining ground-level pressure in the engine induction system up to 20,000ft. Rolls-Royce engines fitted with mechanically driven single-stage superchargers maintain the same pressure up to 30,000ft., and this increase in altitude has been the main means of our achieving technical superiority.

Certain American engines are fitted with exhaust turbo superchargers on the G.E.C. principle, which also maintain sea-level pressure up to 30,000ft., and, although this system is excellent when applied to bomber aircraft, there are operational reasons which, it is said, make it less suitable for fighters.

We shall know more of this anon as certain U.S.A. fighters, including the Republic Thunderbolt, have a turbo exhaust-driven supercharger.



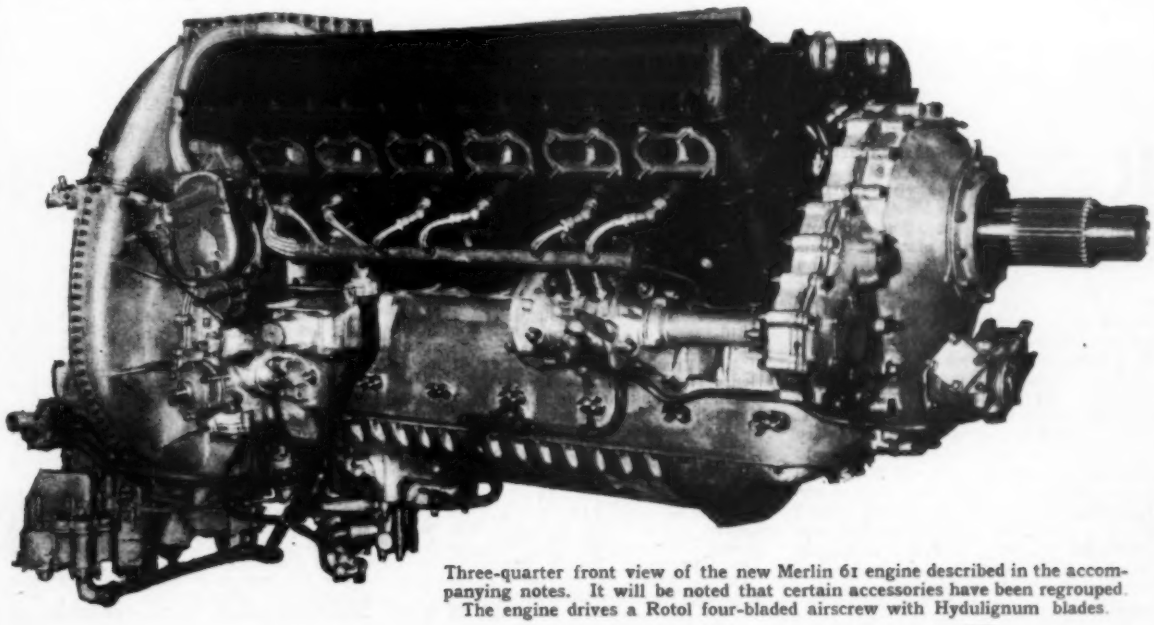
A two-piece cylinder head is used on the 61 engine as well as on certain Merlin XXs. The head is attached to the cylinder block by a series of studs, with metal-to-metal joints between the engine and cylinder sleeves. The complete head and cylinder block is attached to the crankcase by long studs passing upwards from the crankcase. Circulation of glycol between block and head is through a series of connecting ports with rubber seatings.

First practical example

Finally, the two-stage supercharger maintains the desired pressure up to 40,000ft., and stands out above all others as the most potent proved means of obtaining high power and high altitudes. At 40,000ft. the charge is being compressed to six times the surrounding atmospheric pressure, and the power of the original Merlin III engine has been doubled. Two-stage and even three-stage superchargers have often been proposed in this country and abroad, and designs have been illustrated in these columns, but the Rolls-Royce is the first proved example of a multi-stage supercharger in service.

Every aspect of the performance of the wonderful improved Spitfire has been tremendously improved by the introduction of the Merlin 61. Although performance at high altitudes presents by far the most difficult problem, the Rolls-Royce two-stage supercharger and intercooler provides advantages which can be interpreted into performance at lower altitude at will.

Squadrons of the R.A.F. have already been equipped with this outstanding fighter.



Three-quarter front view of the new Merlin 61 engine described in the accompanying notes. It will be noted that certain accessories have been regrouped. The engine drives a Rotol four-bladed airscrew with Hydulignum blades.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

According to Schedule

DESCRIBING the activities of *Luftwaffe* fighters in Russia, a German broadcast gives the following picture of a fighter pilot in action:

"He takes off approximately within one minute after the alert. Three belts have to be engaged—parachute belt, dinghy belt and safety belt. The fighter pilot uses a throat microphone with two membranes. A thin wire leads to the earphones, plugged in by one of the ground crew in advance. A turn of a lever cleans the firearms, another lever cleans the reflex sight in readiness for action and a set of luminous thread crosshairs appears. If necessary, the cockpit can be opened with one movement. At a height of 8,200 or 9,800ft. the pilot puts on his oxygen mask. As soon as the pilot contacts the enemy, he depresses a small lever on top of the control column and the machine guns are thus cocked. The whole aircraft has to be aimed at the objective, and all machine guns fire simultaneously."

THEIR OWN MEDICINE. During the attack on Poland German pilots used to drop harmless looking pencils and packages which, when picked up, exploded in the finder's hands. The Germans now report that Russian aircraft drop these highly explosive booby traps for the souvenir hunting troops. The caption to this picture which appeared in a Berlin periodical is of course indignant about this "new cowardly and base devil's trick."

Italian Maps

THE *Reale Unione Nationale Aeronautica*, or, briefly, the Italian Aero Club, has issued a new series of aviation maps of Italy. One edition in sixty-two sheets, each one 25 × 18½in. large, in 1:250,000 scale, contains all lighthouses, seadromes and landing facilities. Apparently because of the cumbersome size of the sheets and the difficulty of handling, another edition was published to a scale of 1:1,000,000.

In this version, printed in three colours, there are fewer names, the nomenclature of roads and places is simplified, and all figures appear in heavier type.

Special attention was paid to the plastic representation of topographical features.

Coal for Bombers

A FEW interesting figures are given in a German appeal to save fuel. It is stated that 115 tons of coal are consumed in all processes involved in the production of one bomber, and 120,000 tons for one warship. Should each German household save one average-size coal shovel in one week the resulting saving would be sufficient for the production of 22,000 twin-engined bombers.

In a further attempt to illustrate the need for fuel economy it is stated that for the production of one pound of benzine 5.5 lb. of coal are necessary.

Verboten

IN the middle of last month new regulations limiting the consumption of aluminium have been issued by the German authorities. According to these regulations, so-called chief alloys, mainly with copper and magnesium, are generally permitted. All other alloys are declared as "special purpose alloys" and are to be employed only for specific production, such as pistons.

A.T.A. BENEVOLENT FUND

First List of Subscriptions

READERS will recall an article in the issue of September 17th describing a *Flight* visit to H.Q. Ferry Pool of the Air Transport Auxiliary on the occasion of its 100,000th delivery of aircraft. This followed our report of the inauguration of the A.T.A. Benevolent Fund in June of this year. It was launched for the benefit of serving members of the A.T.A. and its funds cover mainly the making of grants to ferry pilots or their dependents in case of incapacity through accident, and to their dependents when lives are lost in the service of the A.T.A.

An appeal for support for this very worthy fund was recently issued to manufacturers of aircraft and firms associated therewith, under the joint signatures of E. Colston Shepherd, B.A., B.Litt., editor of *The Aeroplane*, and G. Geoffrey Smith, M.B.E., managing editor of *Flight* and *Aircraft Production*. A first list of subscriptions is now appended:

	£	s.	d.
Rolls-Royce, Ltd., Derby	500	0	0
R.K.O. Radio Pictures, Ltd.	500	0	0
The Airscrew Co., Ltd.	262	10	0
British Thomson-Houston Co., Ltd., Rugby	250	0	0
"Flight"	105	0	0
Dunlop Rubber Co., Ltd.	105	0	0
"The Aeroplane"	105	0	0
A. Butler, Esq.	100	0	0
Imperial Chemical Industries, Ltd.	100	0	0
The Viscount Runciman	52	10	0
Morgan Crucible Co., Ltd.	52	10	0
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Field Consolidated Aircraft Services, Ltd.	50	0	0
Phillips and Powis Aircraft, Ltd.	50	0	0
Cunliffe Owen Aircraft, Ltd.	50	0	0
Tube Investments, Ltd.	50	0	0
Folland Aircraft, Ltd.	26	5	0
British Celanese, Ltd.	26	5	0
The Educational Supply Association, Ltd.	26	5	0
The Lockheed Aircraft Corporation	25	0	0
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The G.Q. Parachute Co., Ltd.	21	0	0
Singer Sewing Machine Co., Ltd.	10	10	0
Effingham Steelworks, Ltd.	10	10	0
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H 69

Twenty-seventh of the New Recognition Series

AIRCRAFT TYPES AND

DE HAVILLAND MOSQUITO

VERY little information has as yet been released for publication about the De Havilland Mosquito, the R.A.F.'s latest, and probably fastest, light reconnaissance-bomber.

This machine, as described in *Flight* of October 29th, is of wooden construction and is powered by two Rolls-Royce liquid-cooled, 12-cylinder "V" type engines, equipped with De Havilland three-bladed, hydromatic type airscrews, and although performance figures may not yet be mentioned, it goes without saying that they are extremely good. Undercarriage and tailwheel are retractable, but the latter is not completely enclosed.

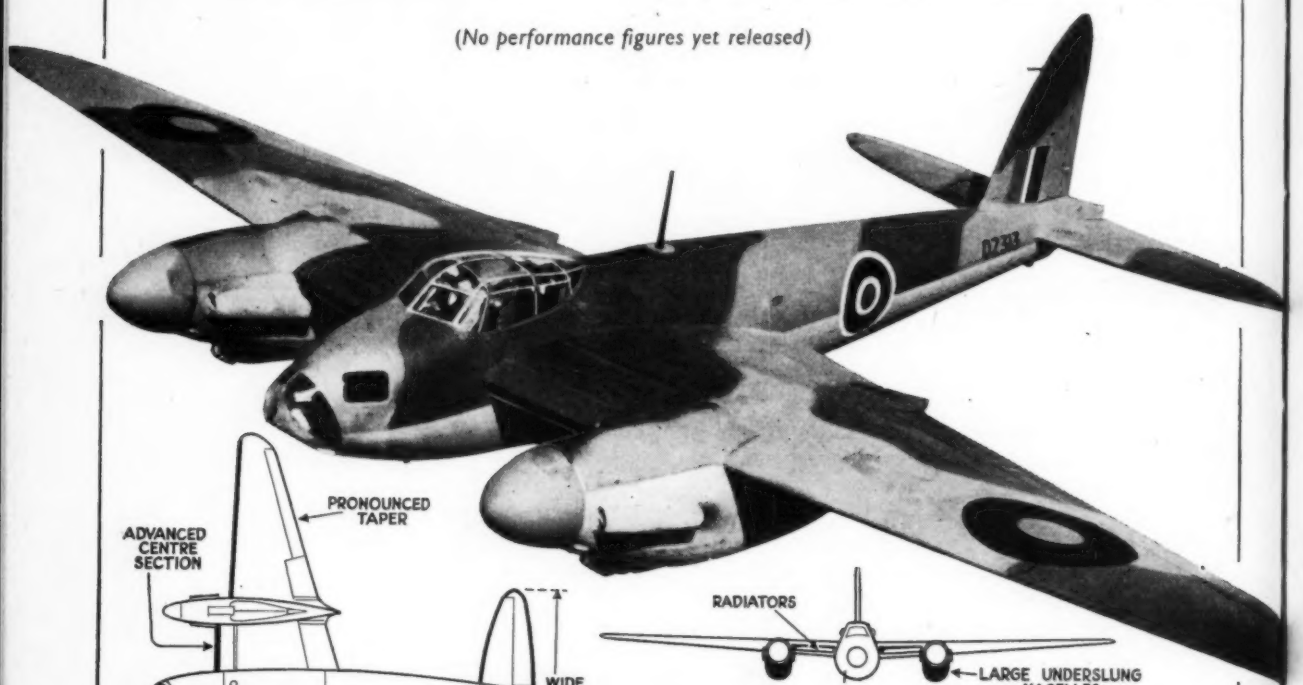
It is, as the accompanying illustrations show, a particularly clean aircraft, with a beautifully streamlined fuselage on which the cockpit cover, while obviously providing good visibility, blends very smoothly into the upper surface. Another good feature, aerodynamically, is the way in which the engine nacelles are underslung, so that their upper surfaces merge into the upper surface of the wings, an arrangement which has been found to give very low drag, as the airflow over the top of the wing suffers a minimum disturbance by the power units.

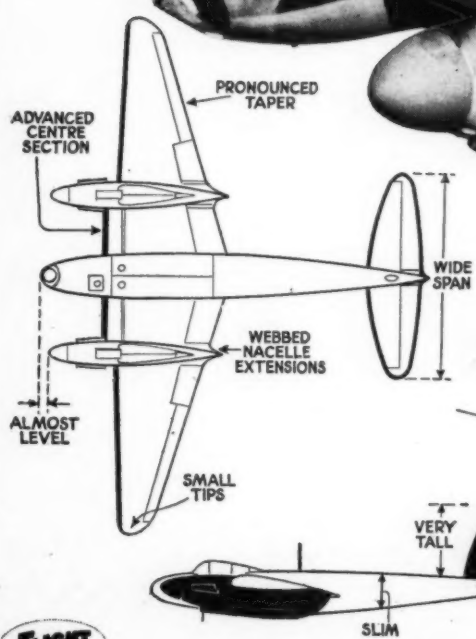
The Mosquito was first officially mentioned when four of them made a daylight raid on the Nazi headquarters at Oslo; since then the type has increasingly figured in successful raids on enemy objectives across the Channel.

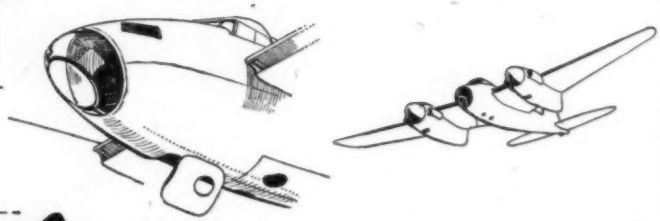
Incidentally, the Mosquito is the first operational type to be developed by De Havilland since the last war, and its simple construction lends itself to widely dispersed manufacture.

Offensive armament may consist of four 20 mm. cannon and four 0.303 machine guns.

(No performance figures yet released)





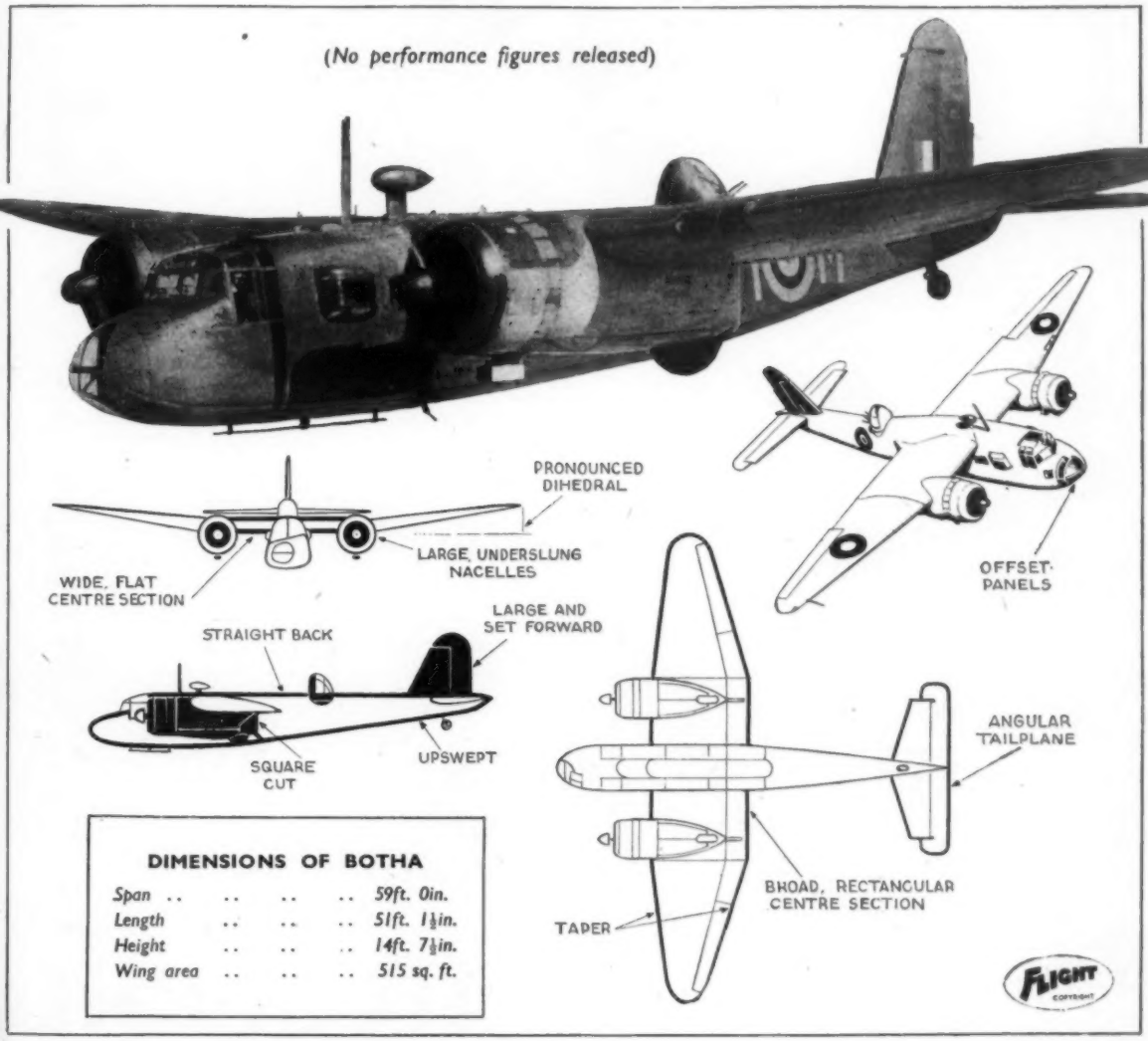


DIMENSIONS OF MOSQUITO

Span	54ft. 2in.
Length	40ft. 9in.
Height	15ft. 3in.
Wing area	420 sq. ft.

EIR CHARACTERISTICS

BLACKBURN BOTHA



DIMENSIONS OF BOTHA

Span	*59ft. 0in.*
Length	*51ft. 1½in.*
Height	*14ft. 7½in.*
Wing area	*515 sq. ft.*

DESIGNED to the same specification as the Bristol Beaufort, the Blackburn Botha was introduced early in 1941 as a torpedo-bomber and reconnaissance aircraft, its prototype having first flown shortly before the outbreak of the present war.

It had an extremely short operational career, however, and although a few squadrons of Coastal Command were equipped with this aircraft, it was only a matter of weeks before it was withdrawn as unsuitable for operational duties and was transferred by the Air Ministry to Training Command, with whom it is still in service. Target-towing is among its present duties.

In 1939 the Botha was demonstrated to Members of Parliament at Northolt, together with certain other then secret types, and was afterwards ordered by the Government in quantity.

Powered by two Bristol Perseus Xa air-cooled, radial sleeve-valve engines each of 930 h.p. (level maximum power), the Botha has an unusual feature in the tubular structure employed in the wings which makes possible a method of external riveting developed by Blackburn, a special type of riveting dolly being used. Its high-wing layout makes it particularly suitable for reconnaissance duties, but other and more important considerations ruled it out for active service operational work, and those squadrons which received the first production Bothas were soon re-equipped with Beauforts or Hudsons.

The wings, which have a wide, flat centre-section, rectangular in plan and of constant thickness, taper somewhat abruptly on their outer panels to rounded tips, most of the taper being on the trailing-edge. There is also a fairly pronounced dihedral angle from the engine nacelles.

The fuselage is all-metal monocoque, and the whole, except for fabric-covered control surfaces, is covered by a flush-riveted stressed skin. Hydraulically operated, split trailing-edge flaps are fitted, and the ailerons, rudder and elevators are aerodynamically balanced.

Full details of the armament are not released, nor any concerning the machine's performance, but it is known that the dorsal turret amidships houses twin machine guns and that there is provision in the belly of the fuselage for torpedo stowage or the equivalent weight in bombs.

A number of these aircraft are doing useful work in the training of air crews for Coastal Command.

WHEREAS TO-DAY!..

• • • whereas to-day, Gentlemen, our position as "Kings of the Cold" is challenged . . . no longer are we the undisputed leaders in the field of cold-resisting clothing! Human ingenuity has overtaken us and it is now part of the air crews' everyday life to don their Irvinsuits and carry on their jobs, warm and comfortable, in temperatures even as low as sixty below. The Irvinsuit has our admiration and envy.

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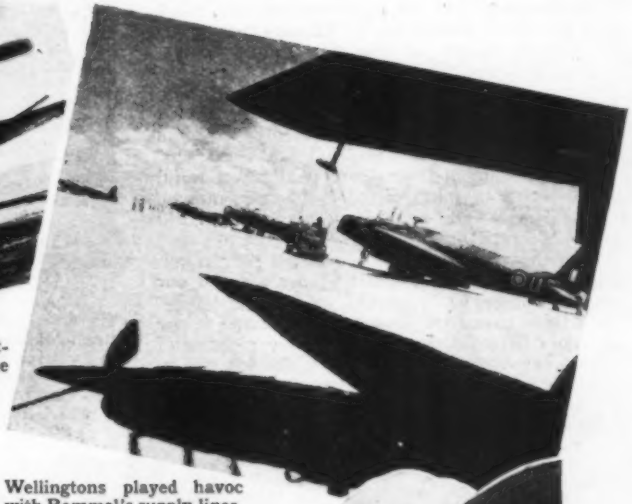
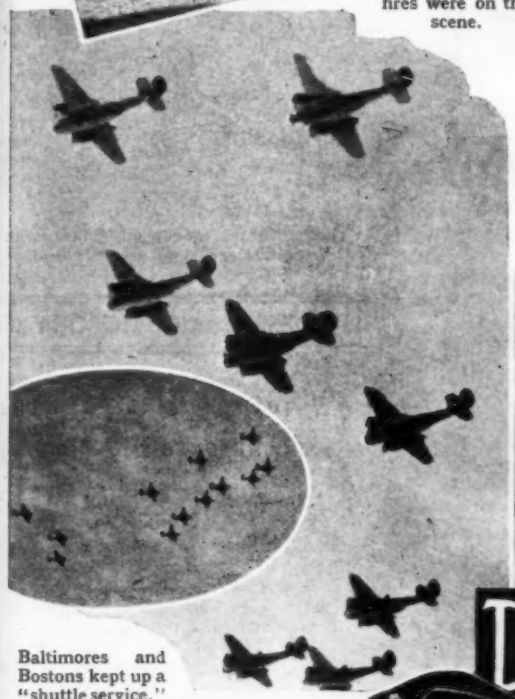
Some of the Aircraft Which Did the Job . . . . . .

Tropicalised Spitfires were on the scene.



Wellingtons played havoc with Rommel's supply lines. (Below) A Kittyhawk being bombed-up in a sandstorm.



Baltimores and Bostons kept up a "shuttle service."

The DESERT AIR VICTORY

"Honestly, I Think That in This Offensive We Have Achieved the Most Complete Defeat of Any Air Force There Has Ever Been"

Air Vice-Marshal Coningham, 26th November, 1942

THESE were the words used by the A.O.C. Western Desert when referring to the sensational defeat of the *Luftwaffe* and *Regia Aeronautica* in the recent battle for Egypt and Cyrenaica. He was also most scathing in his contempt for the German Air Force which, as he put it, "had left their ground forces to be pounded by Allied airmen in a quite disgraceful manner. They did not carry out one proper dive-bombing attack during the entire campaign."

Speaking of the much-vaunted German flair for organisation, he said, "They appear to be most inefficient people when they are not in overwhelming force with no one to stop them." He went on, "You may think of what they did in Crete and Greece, but remember in this campaign the Germans have had a whole string of airdromes behind them going right back into

Air Chief Marshal Sir Arthur Tedder (then A.O.C.-in-C. Middle East), with (right) Air Vice-Marshal A. Coningham, A.O.C. Western Desert, at Advanced Air Headquarters.

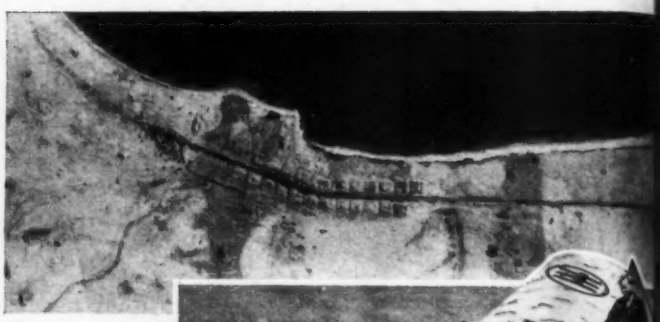
their own country; yet they have been completely beaten in the air.

"Everything you see destroyed on the roads or in the desert behind the El Alamein front testifies to the worth of our Air Forces—tanks, lorries, and everything.

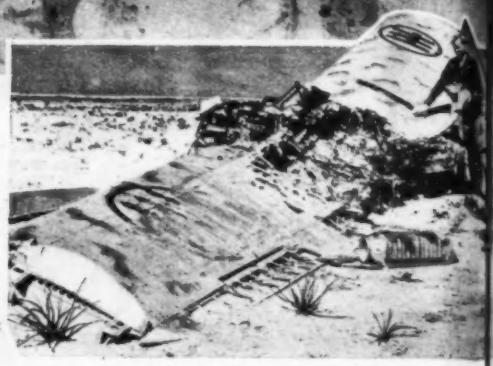
"Those tanks and lorries have either been bombed or machine-gunned from the air or run out of petrol because the Air Force cut off the enemy's supplies, either on land or at sea."

Air Vice-Marshal Coningham paid a wonderful tribute to our ground crews—old desert rats he called them. "Our ground and air transport did 48 hours' work in every 24. The ground crews worked so well that when we reached the Tobruk area after five days, we had 95 per cent. of our machines in service."

On these pages are photographs of some of the machines that did the job and many pictures of scenes of destruction passed during the advance to El Agheila. Over 500 destroyed or damaged aircraft were found on reoccupied landing grounds, and over 230 were destroyed in air combat.



The never-ending stream of retreating vehicles as they passed along the coast road near Sollum.

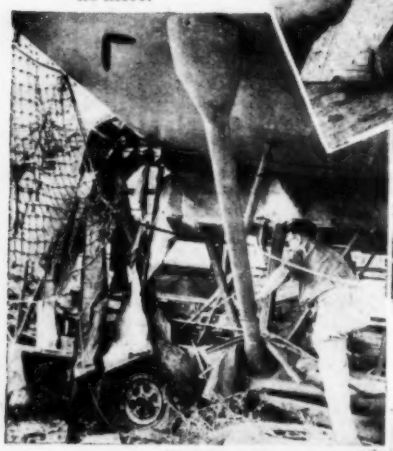


One of Italy's monoplane fighters with the fuselage completely burnt out.

THE DESERT AIR VICTORY (Con

Photographs of the Shambles Left Behind by Rommel's Airmen

(Above) An Axis lorry still burning when our forward troops arrived. (Right) An Me 109F which will fight no more.



(Left) Our salvage people get to work and lay out repairable material on the desert. (Below) The tail of a He 111 blown right off its fuselage.

(Above) An R.A.F. Intelligence officer inspects the remains of a Gotha 242 glider. (Right) A row of fuselages which had been shot up by our cannon-armed fighters.

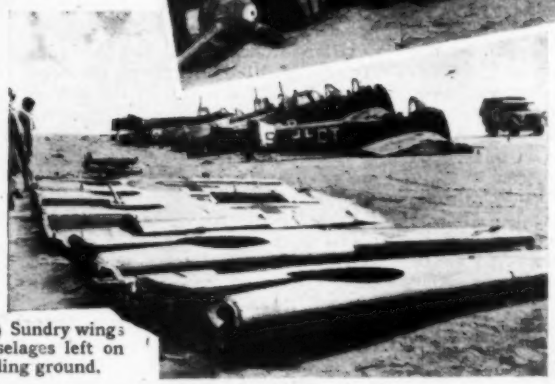
Dive-bombers' bombs left on the sand.

(Left) The hull of a Dornier Do 20 flying boat left on its improvised stocks at Mersa Matruh

ght) A Hurricane erses itself near remains of an Me 110.

(Above) An Me 110 almost untouched.

(Below) A "scorched" Me 109.



Above) Sundry wings nd fuselages left on a landing ground.

(Left) The wrecks of an He 111 and an Me 109 which will never escort it again. In the background is a Hurricane.

(Above) A much-bedraggled Me 109. (Left) More Me 109s in their blast bays in the Daba area. The one in the background is almost intact.

(Below) A line of fuselages collected by our salvage crews immediately after the occupation of Daba.

(Left) This wrecked Fiat CR 42 looks particularly pathetic as the transport of our advancing Eighth Army streams past on the way to Benghazi.

TRANSPORT AIRCRAFT

Some Past Achievements and Future Problems : Post-war Developments

By W. NICHOLS, A.R.Ae.S

Medium-altitude as well as high-altitude versions of the Short 14/38 were in hand when war broke out.

BRITISH civil aircraft were approaching the front rank of the world's flying transports when war broke out. The position at that time was encouraging. The Air Ministry had already placed an order with the Fairey Aviation Company for fourteen commercial aircraft, known as the FC 1. The gross weight was to be 42,000 lb. and the machine a low-wing, all-metal stressed skin monoplane with retracting tricycle undercarriage and four Bristol engines of 1,000 h.p. each. The fuselage was designed for supercharging at altitude. The FC 1 represented a great advancement in design. Provisional details of the Fairey FC 1 were as follows:—

The Fairey FC 1

Span	105ft.
Length	82ft.
Wing area	1,300 sq. ft.
Wing loading	32.5 lb./sq. ft.
Inside cabin length	32ft.
Inside cabin width	10ft.
All-up weight	42,000 lb.
Pay-load (500 miles)	9,500 lb.
Payload (1,700 miles)	4,500 lb.
Range (50 per cent. power)	1,700 miles
Max. speed (13,000ft.)	275 m.p.h.
Cruising speed (60 per cent. power)	225 m.p.h.
Stalling speed	70 m.p.h.

The Air Ministry had also announced that three large landplanes had been ordered from Short Bros., two for operations at more or less normal heights, and one with a pressure cabin for high-altitude work. The engines were to be four Bristols of 1,600 h.p. each, and the machines were of the high-wing type, to be known as the Short 14/38. The range of these aircraft was expected to be well over 3,000 miles. Thus two-stage journeys from London to India, West Africa and South America would have been possible, as well as non-stop runs to all the more distant cities of Europe, and over long sections of the Empire routes. Particulars of these aircraft, which were expected to be ready under normal conditions sometime in 1940, are given below:—

The Short 14/38

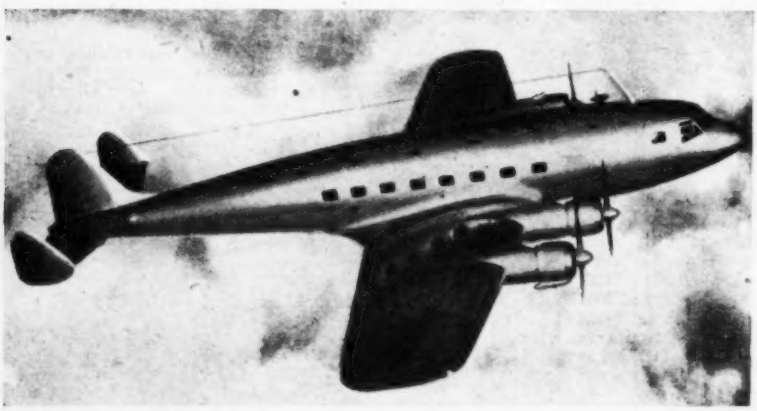
Span	127ft. 6in.
Length	89ft.
Wing area	1,800 sq. ft.
Weight empty (standard)	39,050 lb.
Weight empty (high altitude)	41,310 lb.
Payload with crew (standard)	8,000 lb.
Payload with crew (high altitude)	8,800 lb.
All-up weight (both)	71,000 lb.
Cruising speed (10,000ft.)	246 m.p.h.
Cruising speed (25,000ft.)	275 m.p.h.
Service ceiling (standard type)	20,200ft.
Service ceiling (high-altitude type)	32,500ft.
Range (standard)	3,420 miles
Range (high-altitude)	3,370 miles

On the declaration of war, civil aviation ceased to exist and the industry concentrated entirely on the needs of the Royal Air Force for the successful prosecution of the war. There was some doubt at the time, and since, as to the wisdom of this policy, for coming events do not always cast their shadows before. Many unforeseen circumstances have been brought about since September, 1939, and exactly three years later, almost to the day, *Flight*, in its issue of September 3rd, 1942, in an article entitled "We Must Ship By Air," in the opening paragraph quoted the words of Mr. Churchill in the House of Commons in answer to Members pressing for transport aircraft: "If I were asked which I preferred, 1,000 bombers or 1,000 transporters, I should find it difficult to decide; I should take advice."

What Might Have Been

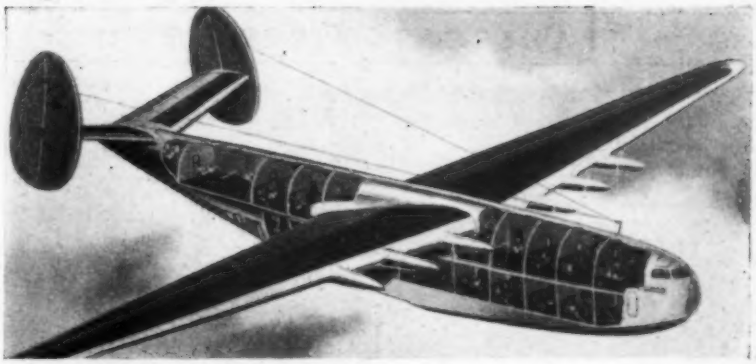
The idea has spread that air transport must play a further part in the war, and even a mere 500 aircraft of the 14/38 class would have been a great asset to the nation in this phase of the war had we found it possible to carry out our civil programme. In contrast to this, however, an abstract from the House of Commons Official Report for September 30th, 1942, states: "Asked what steps had been taken to plan for a large future construction of cargo-carrying aircraft in this country to meet post-war needs, and whether he would now set up a special commission of expert engineers and business men to consider the whole problem and report," the Minister of Aircraft Production said: "While the Government intends to deal with this matter at the appropriate time, I am afraid that at the present stage of the war the whole efforts of the expert engineers of the aircraft industry must be concentrated on work for war purposes."

The significance of the reply depends to some extent on the definition of the term "expert engineer" as used by the Minister of Aircraft Production. One hears too frequently of some who



Model of the Fairey FC 1 monoplane, which was to have a pressure cabin.

TRANSPORT AIRCRAFT



Part-sectioned model of the Martin 100-passenger transport. Estimated gross weight was 125 tons.

an claim to be experts that they are ot exactly feeling the strain due to heir concentration on war work. In act, some claim that they are not ven being usefully employed. Posibly the Minister of Aircraft Production would not consider any of these nen to be qualified for the post of hief designer of a post-war transport roject, but there need be only one hief designer, and it does not seem likely that the absence of one chief esigner is likely to hamper our war ffort.

The reference by the Minister to the "appropriate time" is taken to mean t the end of the war. A period of t least two years will then be required to design and construct a nodern airliner such as will be required for the post-war period, and a urther period will elapse before production is complete, from which it ppears that it will be at the very east three to four years after hostilies have ceased before any modern ir transport is available from the British aircraft industry, either for se within the Empire or for sale to oreign markets.

New Giants

It is of interest to compare our osition with that existing in America. ur Allies are already operating ying boats of a gross weight between 2,000 and 84,000 lb., carrying a payad of approximately 4,000 lb. a istance of between 3,000 and 4,000 iles. The world's largest flying boat, he *Mars*, the gross weight of which 140,000 lb., has undergone tests om which valuable experience will e gained. The Glenn L. Martin ompany have completed the designs r an aircraft of 250,000 lb., which, is claimed, will fly from New York London non-stop in 13 hours carryg 100 passengers, 8,000 lb. of baggage and 25,000 lb. of mail or cargo, while Mr. Grover Loening visualises a 450-ton aircraft. Other projects are the Boeing 100-passenger six-engined flying boat and the Sikorski designed to the same Pan American specification. These are only some of the projects taking shape across the Atlantic.

The war will have "sold" ocean air transport to the world. From the perils of the war will come a degree of safety in air travel far superior to the pre-war era. Radiolocation; devices to beat fog and ice formation; these and other wartime inventions will be handed over for the benefit of civil aviation, and will ensure that regularity of service which could not always be achieved before the war.

All first-class mail must be transported by air when peace comes. A weary world will need to be drawn closer together and the threads of commerce re-established by the fastest and safest means of transport.

Probably the greatest development will be with the flying boat or, as it will be termed in the post-war era, the flying ship. It seems, therefore, that America will be the only nation which will be in a position to supply modern air transport at the close of hostilities. It also seems that the mighty power of Britain in the air will have to start once more a belated though smaller programme of aircraft production to maintain equality in commercial aviation. It is a great pity, therefore, that we are not able to do something about it now, for the subject is one of extreme complexity and its importance cannot be overrated.

We have never in this country attempted the design of an aircraft of the overall size and dimensions that will be necessary for the post-war era, and the remainder of this article is devoted to arriving at some conclusions and essential features of the post-war monster.

There are literally thousands of points upon which information must be obtained, and this article can only briefly refer to a few. Apart from aerodynamic and engineering problems, one of the most important is passenger accommodation and comfort.

Pressure Cabins

On all long-distance airliners of the future it is probable the pressure cabin will be incorporated. The points in favour of this may be summarised as follows: Sleepers do not suffer with change of height, as the eardrums are not affected; noise level is reduced; temperature remains constant, and draught is non-existent.

Already in America Pan American Strato-Clippers and T.W.A. Stratoliners were the world's first transport craft in service to have a pressure cabin for comfortable flight at high altitudes.

The system maintains low-level conditions for passengers and crew at altitudes up to 20,000ft. Between 8,000 and 14,700ft. the pressure condition in the cabin remains the equivalent of 8,000ft. At 16,000ft. the "pressure altitude" in the cabin is 9,000ft.; at 18,000ft. it is 10,600ft.; and at 20,000ft. it is 12,300ft. In other words, between 14,700ft. and 20,000ft. the pressure inside the cabin exceeds the outside atmospheric pressure by 2¼ lb./sq. in. This is actually less than half the pressure difference for which the cabin was designed, viz., 6 lb./sq. in. In the opinion of

The Martin *Mars* goes half-way towards future giants, with a gross weight of 70 tons.

TRANSPORT AIRCRAFT

The Boeing Stratoliner has a fuselage of "hour-glass" section, internal pressure putting the cabin floor in tension.

the writer this needs to be improved upon, for many passengers would experience discomfort at 12,000ft., and, if possible, the pressure condition within the cabin should not exceed the equivalent of 10,000ft., or even less.

Some of the design problems encountered are structural, especially where break-away from contour becomes necessary to provide windscreens, doors, etc., cut into the main structure.

Other problems are the design of proper glands for the control runs, and avoidance of contamination of the air supply to the cabin; provision of valving apparatus to maintain steady pressure; and safeguards to avoid fluctuations in pressure dangerous to passengers and crew.

Prior to the war General Aircraft, Ltd., were engaged upon the design of an experimental pressure cabin aircraft, and many useful data were obtained. The "passenger comfort chart" presented on page 667 was enlarged upon by General Aircraft, Ltd., to include the effects of pressure change, CO_2 concentration, and humidity. As will be seen, they inserted what they term a "luxury zone." The "psysiological boundary" marked on the chart can be defined as the limit of passenger endurance for long periods. Beyond this boundary the average passenger will be affected by extremes of heat, cold, pressure, or by lack of ventilation. Figures marked on the outside circle represent the limits which the cabin conditions should not exceed. Air pressure above 20,000ft. will cause nose bleeding and a feeling of exhaustion. A pressure change equivalent to a descent of 1,000ft. per minute will cause pain in the ears of a sleeping passenger. A supply of less than 5 cu. ft. of air per minute to each passenger, or the presence of 10 per cent. of CO_2 concentration, will cause fainting, distress and fatigue.

The "psychological boundary" marks the transition point between discomfort and comfort. General Aircraft, Ltd., state it is impossible to fix this point very closely, since reactions vary, but the figures marked on the intermediate circle represent a set of conditions under which the average passenger will have little cause for complaint. In the opinion of this company prior to the war, air transport should incorporate, by the introduction of the pressure cabin, the conditions marked by the line between comfort and luxury zones.

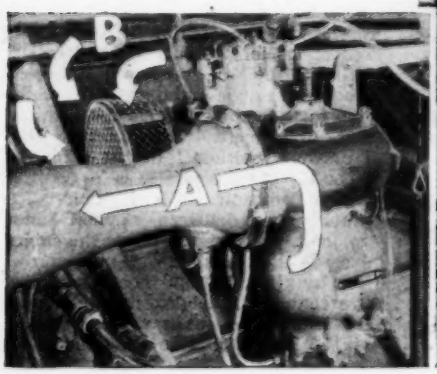
Supercharging

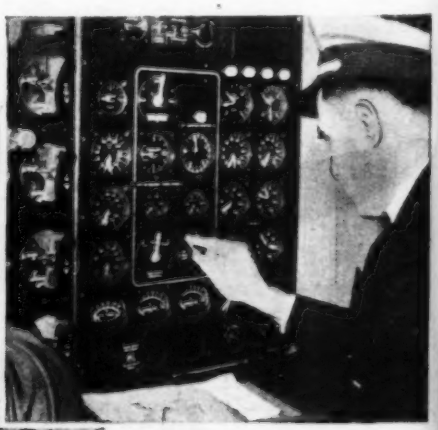
It is probable that all long-distance aircraft of the future will fly at an altitude of approximately 20,000ft., due to the fact that take-off and landing conditions determine the wing loading. This is always too small for economical flight at low altitude because, at the small angle of incidence necessary, the L/D of the aircraft is small. If the machine flies at 20,000ft. at the same speed, the angle of incidence is considerably greater and the L/D increases also. This is the aerodynamical advantage of flying at a high altitude, and the pressure cabin seems to be the only possible solution for commercial purposes.

Supercharging the cabin will be carried out by engine-driven pumps, or

One of the two engine-driven pumps which deliver compressed air to the cabin.

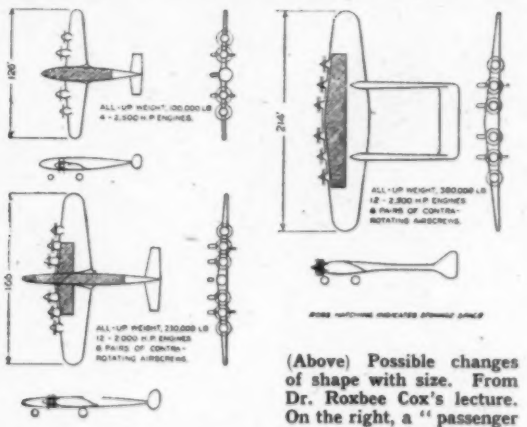
(Below) Compressor of Boeing Stratoliner. A and B indicate compressed and spent air respectively.



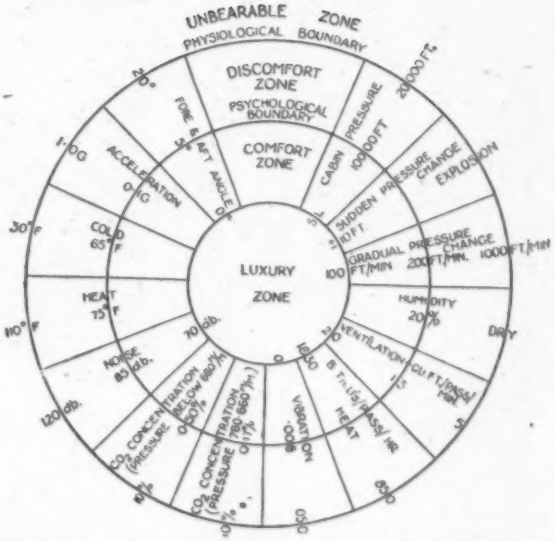


The flight engineer of the Stratoliner watches his instruments. Those in the white frame show cabin conditions.

TRANSPORT AIRCRAFT


ALL-UP WEIGHT, 100,000 LB
4 - 2,500 H.P. ENGINES.
ALL-UP WEIGHT, 380,000 LB
12 - 2,500 H.P. ENGINES
6 PAIRS OF CONTRA-ROTATING AIRSCREWS.
ALL-UP WEIGHT, 230,000 LB
12 - 2,000 H.P. ENGINES
6 PAIRS OF CONTRA-ROTATING AIRSCREWS.

(Above) Possible changes of shape with size. From Dr. Roxbee Cox's lecture. On the right, a "passenger comfort chart" prepared by General Aircraft, Ltd.



by an alternative scheme using an auxiliary engine and supercharger unit within the fuselage, at the rear of the pressure cabin. The former, however, seems the logical method to adopt.

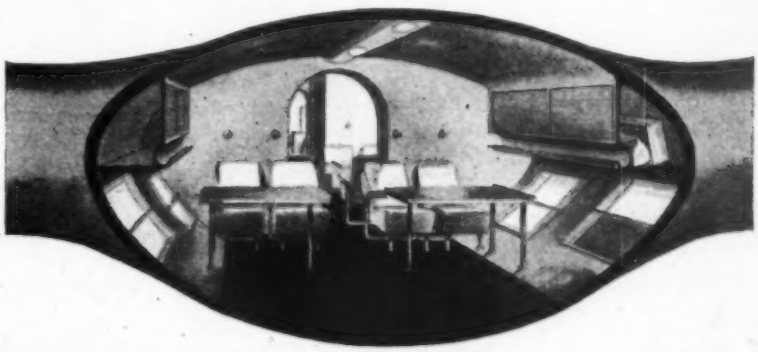
So far as one can gather, the layout of the post-war projects appears to be on the orthodox lines of either low-wing or high-wing monoplanes. As the size of aircraft increases, the advantages of the low-wing arrangement are not so apparent.

Unorthodoxy

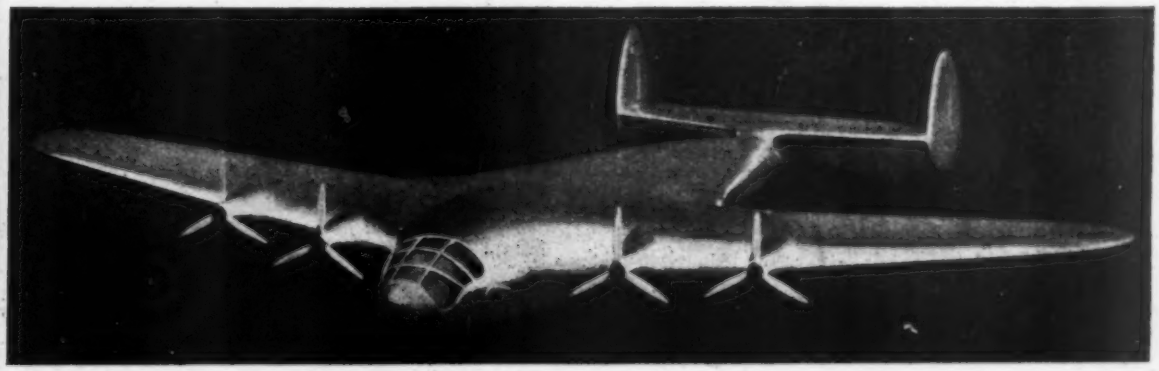
There seems to be justification for departing somewhat from orthodox layout for the future giant of the air. As times goes on it is possible we shall see developments on the lines of the Cunliffe-Owen (Burnelli), Junkers all-wing type of aircraft, or upon the lines of that excellent layout by Mr. F. G. Miles, known as the Miles X2 Transport, the plans for which were well advanced in 1938. In this the fuselage merged into the wing and the spars divided it into three main compartments. It is also possible the tailless aircraft upon the lines of the new Northrop will eventually make its appearance.

Dr. Roxbee Cox, when delivering the Wilbur Wright Memorial Lecture to The Royal Aeronautical Society two years ago, said: "When the wing has reached a size capable of containing passengers it is clearly wasteful not to make some reduction in fuselage size, and when the wing is able to contain all the useful load, a fuselage is unnecessary." Continuing, and basing his assumptions upon a wing loading of 50 lb./sq. ft., Dr. Roxbee Cox stated that at a gross weight of 100,000 lb., the wing begins to have a little accommodation in it. For a 15 per cent. stowed load at a gross weight of 280,000 lb., the wing can accommodate as much as the fuselage. At 380,000 lb. there is no need for a fuselage.

(To be continued next week.)



Section through cabin and wing of the Miles X2 design of 1938. Note how the fuselage sides merged into the wing surfaces.



Scale model of the Miles X2 transport, which was based on the Rolls-Royce "X" engine.

THE SCRAP-HEAP : £300,000 worth of spares have been recovered from crashed engines in two years.

P.E.R.A.

Past — Engines — Return — Again

THAT is not the correct definition of P.E.R.A., but it does describe in four words one of the principal and most interesting activities of the Propeller and Engine Repair Auxiliary, a base of British Overseas Airways Corporation. "How Green is my Valley" less than three years ago would have aptly described this South Wales countryside where the base is now situated, and which *Flight* was recently privileged to visit by the courtesy of B.O.A. and the Ministry of Aircraft Production.

A string of well-laid-out factories, comprising the Engine Overhaul Department, under Mr. G. A. Hummerstone, the Overhaul Superintendent, was transferred to this site in June, 1940. In these factories the overhaul of Bristol engines for the R.A.F. was undertaken, and the first deliveries to the Service began exactly one month later, and have continued since at a most satisfactory rate. The various shops visited by *Flight* included planning, stores, dismantling and cleaning, inspection, cylinder overhaul and sub-assembly shop, magneto and carburettor shop. Everywhere one noticed a high degree of efficiency and good organisation in spite of the high percentage of semi-skilled and female labour involved. Perhaps this is readily understandable when one realises that Mr. Hummerstone has been connected with this work since the earliest days of civil aviation, just after the last war, continuing with Imperial Airways, Ltd., until the present time, and assisted by such able men as Mr. Drage, Senior Foreman, Mr. Metcalf, Assistant Inspector-in-Charge, and Mr. Titmus, Production Control Assistant.

During the past two years considerable expansion has taken place. The total strength has increased nearly sevenfold, and, more important still, the average rate of engine output is now eleven times greater, a most satisfactory achievement.

It should be stated that at the beginning no female labour was involved, but at the present time over 38 per cent. of the total staff are females.

The section dealing with the breakdown and salvage of

CUTTING-UP A CRASHED ENGINE. Inspection may prove that many internal parts can be reconditioned.

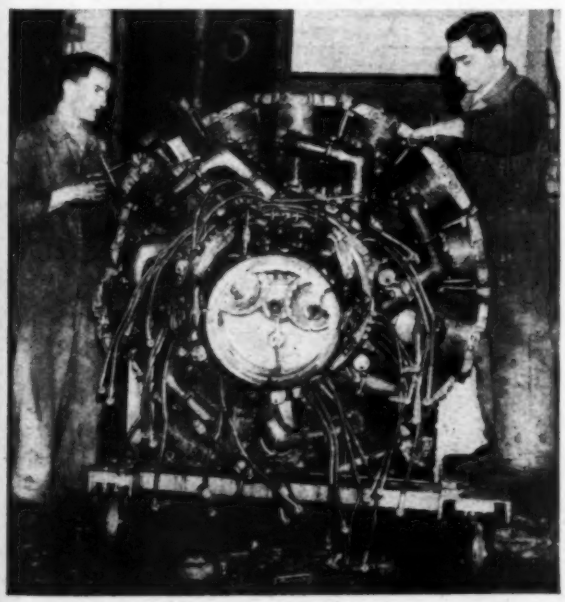
P. E. R. A.

spares from engines damaged beyond economical repair is the idea of Mr. J. H. Robson, the Service Engineering Director of B.O.A., who, finding it difficult to obtain spares for the engine maintenance of his fleet, hit upon the brilliant idea of salving suitable engines from crashed aircraft. The idea was adopted by the authorities and has proved since to be of inestimable value in the war effort, and, incidentally, to the taxpayer too. Work commenced in this section in November, 1940. Some 2,500 different kinds of spares have been salvaged in this process.

As an example of the value of the scheme, the total cost of running this shop for a year was recently compared with the cost price of the total of 35 main items salvaged. The items considered were those in constant demand. A financial saving of some £120,000 was shown by this comparison alone, and is sufficient evidence of the good work being done in this section.

"Dug-outs"

We first visited the "scrap-heap" where the crashed engines are dumped by the R.A.F. as beyond repair. Many still were plastered with the earth out of which they had been dug as the result of a crash, sometimes embedded to a depth of ten or more feet; most of them bore evidence of the fire that obviously followed. What were once magnificent Bristol aircraft engines lay here a mass of twisted, cracked and rusty metal, with little or no resemblance to their former magnificence. One by one these derelicts are scrutinised, and any part showing signs of further service noted; then the breakdown commences, spanners, hammers and oxy-acetylene cutters being the tools prominently used. The units, however small, that appear undamaged, even nuts and bolts, small bearings, etc., as well as cylinders and even larger components, are thoroughly cleaned and submitted to the most rigid inspection. The remainder is broken up for scrap, categorically sorted, and sent elsewhere to be melted down. By this means a huge number of parts are eventually passed by inspection for further use, and when it is realised that a cylinder costs approximately £90 to produce, the great financial saving is obvious. The most important saving, however, is in man-hours, for every item salved for future use is saving many hours of most valuable time in the factories. Passing to the stores gave a good indication of the value of this section, for here



PAST ENGINE RETURNS AGAIN: Erecting a Hercules.

Microscopical examination of a salved impellor on the hardness testing machine.

were engine spares of all descriptions having been salved, cleaned and inspected, once again as good as new—crankcases, cylinders, sub-assemblies, including airscrew reduction gears, superchargers, etc., all available for erection or for supply elsewhere on demand.

In the erection shop Bristol Pegasus and Hercules engines were being assembled. For this purpose a neat compact fixture is used, mounted upon four small wheels, which can be conveniently moved to any part of the shop. Whilst under erection the engine can be either in the vertical or horizontal position for convenience of the fitters.

Final Tests

The tour was concluded with a visit to the test beds. This section of the factory is under the control of Mr. Hole and the first shop visited contained a number of engines receiving final adjustments to tappets and magnetos, etc., prior to being run on test. After test the engine is again returned here and run over for any minor adjustments that may be necessary. Two Wright Cyclone engines were also receiving attention here.

We visited three of the eleven test beds where Pegasus and Hercules engines were being run. Beside each test bed is the control room, the operator and controls being on a level with the engine under test. A large glass panel gives the operator a full view of his charge and beneath this panel are mounted horizontally the usual instruments, tachometer, oil pressure and temperature gauges, etc., grouped just forward of the controls.

The last shop to be visited was Final Inspection. It would be difficult for the layman to appreciate that many of the parts of these engines mounted on a neat stand at a convenient height and with every appearance of being new came from off that "heap of scrap" at the other end of the factory. A card attached to each engine informs the Inspector of the various items to be finally checked. A signature at the bottom certifies the engine as airworthy and thus from P.E.R.A. Past-Engines-Return-Again.

Before leaving, we had the pleasure of meeting Mr. A. J. Quin-Harkin, Director-in-Charge. Mr. Quin-Harkin has served Imperial Airways and now B.O.A. for many years past with distinction and was well known on the Continent before the war. His capable leadership, combined with the exceptional experience of Mr. G. A. Hummerstone, Superintendent, is largely responsible for the great expansion of this base and its increased output over the past two years. The male and female employees of P.E.R.A. are doing excellent work servicing the R.A.F. and maintaining the all-important fleet of B.O.A. with a constant supply of much needed engines and spares.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

TORPEDO BOMBERS

Advantages of Land-based Aircraft

I HAVE been interested in various letters and articles published recently in *Flight* on the subject of torpedo bombers. Unanimity prevails on the point that the aircraft must be specialised, and one assumes its ability for scoring a torpedo hit on an enemy ship is not to be impaired by having to carry a camera, or bombs, or guns and gunners.

Most contributors appear to assume that the machines will be based on an aircraft carrier. The limitation on aspect ratio and the complication and additional weight involved in folding wings and arrester gear are eliminated if we assume land-based aircraft.

If the machines are still further specialised in that two out of 20 are of a different type and have responsibility for all the navigation and communications with base and carry crews to suit, but no torpedos, then the remainder could be reduced in radio equipment to the bare minimum needed to receive instructions from the navigating machine. In operations the navigating machines would not approach closer than was necessary to indicate the target to the remainder, but would stay in the background, ready to conduct the team back to base.

The relaxation on landing and take-off run limitations obtained with land-based aircraft would have its beneficial effect on top speed, and whilst the torpedo bombers could not expect complete immunity from machines from enemy aircraft carriers, this would at least give them a chance of success.

Achievement of their object would be ensured by the overwhelming numbers which it should be possible to put up from land bases. The necessary concentration would be achieved by moving aircraft up to favourable airfields in relation to the enemy fleet's position rather than trying to take an unfavourable airfield (i.e., aircraft carrier) to the scene of operations.

In this way it should be possible to make it highly dangerous for an enemy fleet to approach within, say, 300 miles of strongly held land bases—largely to neutralise sea power, in fact.

The possibility of our enemies adopting the same tactics is apparent, and one imagines that the Japanese operation against H.M.S. *Prince of Wales* was, at least in part, based on such a plan.

J. F. CUSS.

WELDING OF MAGNESIUM ALLOYS

Oxy-Acetylene Process Demands Plain Butt Joints

IN the brief description of the new American "Heliarc" method of welding magnesium contained in your issue of November 5th, 1942, appears the statement, "since the successful welding of magnesium was hitherto regarded as impossible, the Northrop process has come in time to make possible the use of this material in aircraft production."

The device, applied in the new process, of substituting a blanket of inert gas for welding flux is most interesting, but your statement infers that no magnesium alloys are used in the construction of aircraft and that no process of welding has ever been applied to them because of technical difficulties.

This is, of course, quite inaccurate. Oxy-acetylene welding of magnesium alloys has been widely practised for a number of years, particularly in the construction of aircraft fuel and oil tanks, seats, miscellaneous panelling, etc., for which special principles of design have been developed to take full advantage of the particularly good welding properties of the alloys. The greater part of the very large tonnage of magnesium alloy components in present-day Service aircraft is in the form of castings, but a high proportion of the sheet and extrusion is used in the production of the above-mentioned articles.

The oxy-acetylene welding process involves the use of a suitable flux to protect the surface of the parent metal and filler-rod from oxidation, and in designing magnesium alloy components for welding, plain butt joints are, or should be, always specified to ensure that no flux can lodge in corners or be trapped in laps from which it could not be removed by the normal process of washing and scrubbing in hot water. Nature has been kind enough to arrange that this form of joint is generally mechanically superior to the lap or intersection joint, particularly in respect of fatigue endurance. It also carries the obvious advantage as regards economy of material and surface smoothness.

Experience urges caution in departing from this type of joint, flux entrapment or no flux entrapment, and, therefore, the suggestion, coupled with the introduction in the U.S.A. of the "Heliarc" process, that it opens up new vistas of design possibility, should perhaps be taken with reserve unless or until full research and service experience has proved such to be the case. According to the claims made for the process, however, it appears that it can also be applied to the normal butt joint, and if the process is fundamentally sound and practically efficient, one would advise that for components subject to fatigue or direct static loading this type of joint should be specified for the "Heliarc" as well as for the oxy-acteylene process.

The claimed advantages of the "Heliarc" process, viz., the possibility of the extended use of welding as applied to magnesium alloys and reduction of weld distortion by the local nature of the application of heat, are certainly desirable, and it will be interesting to observe whether these will outweigh the advantages of the oxy-acetylene process—speed, ease of manipulation and mobility, assuming problems of supply and high cost of helium or other gas in this country could be solved. The answer will probably be that each process has its own uses. Any advance on the lines claimed for the "Heliarc" method would be warmly welcomed by metallurgists and aircraft designers.

REDLEW.

LOCKHEED VENTURA

FIRST mentioned officially as having taken part in the daylight raid on the Philips factory at Eindhoven, the Lockheed Ventura — Bomber Command's latest acquisition—is the military version of the Lodestar, just as the Hudson was the military version of the Lockheed 14.

It is powered by two Pratt & Whitney 18-cyl. 2,000 h.p. Twin Wasp engines, but no performance figures may be published. Its armament includes two machine guns in the upper turret, two behind the bomb bay and probably others in the nose. Span 65ft. 6in., length 57ft. 6in. Its twin tail has a span of 25ft. 10in.

"Flight" photograph.

IN BRITAIN NOW: A Lockheed Lightning of the 4th U.S. Fighter Group folds its legs immediately after taking off. The engines are two liquid-cooled Allisons with exhaust-driven turbo superchargers.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

The London Gazette, December 4th, 1942.

GENERAL DUTIES BRANCH.

Air Cmdres. (temp.) are granted the rank of Grp. Capt. (war subs.), December 1st, 1942.
D. V. CARNEGIE, A.F.C.
A. L. PAXTON, D.F.C.

EQUIPMENT BRANCH.

Grp. Capt. T. E. DROWLEY, O.B.E., to be Air Cmdre. (temp.), November 1st, 1942.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards: For gallantry, skill and resolution in H.M. ships escorting an important convoy to North Russia in the face of relentless attack by enemy aircraft and submarines.

DISTINGUISHED SERVICE ORDER

Lt. (A) P. W. V. MASSY, D.S.C., R.N.

DISTINGUISHED SERVICE CROSS

Temp. Sub. Lt. (A) I. P. GARROW, R.N.V.R.
Temp. Sub. Lt. (A) A. R. LAURIE, R.N.V.R.
Temp. Act. Sub. Lt. (A) P. J. WILLIAMS, R.N.V.R.

BAR TO DISTINGUISHED SERVICE MEDAL

C.P.O. (Air Fitter E) E. J. MARTIN, D.S.M.

DISTINGUISHED SERVICE MEDAL

Act. Air Art. 4th Cl. R. ELLIOTT.
Act. Air Fitter 4th Cl. R. MERCER.
Ldg. Air Fitter (A) W. O. FOOTE.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of distinguished services:—

MILITARY CROSS.

Flt. Lt. R. WALTON.
P/O. T. J. CORKRAN, R.A.A.F.

MILITARY MEDAL.

Sgt. E. J. BOOKER.
Sgt. A. R. EVANS.

Sqn. Ldr. Billy Drake, D.F.C. and Bar, who has recently been awarded the D.S.O. The citation appears on this page.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

DISTINGUISHED SERVICE ORDER.

Sqn. Ldr. B. DRAKE, D.F.C., No. 112 Sqn.—Since being awarded a bar to his D.F.C., Sqn. Ldr. Drake has continued to display the utmost courage and determination in operations against the enemy. In September, 1942, he led his wing with great determination against a formation of enemy dive-bombers escorted by fighters. In the ensuing combat four bombers and one fighter were destroyed. On a number of other occasions this officer has led bombing and low level machine gun attacks with devastating results.

BAR TO DISTINGUISHED FLYING CROSS.

Act. Sqn. Ldr. S. P. DANIELS, D.F.C., R.A.F.V.R., No. 83 Sqn.—Since being awarded the D.F.C. this officer has participated in numerous successful sorties. His attacks have at all times been pressed home with great determination, and excellent photographs of the target area have frequently been obtained. One night in July, 1942, Sqn. Ldr. Daniels piloted an aircraft detailed to attack Hamburg. On the outward flight, shortly after setting course from base, one of the engines caught fire and became useless. Despite this, Sqn. Ldr. Daniels flew on to his objective and, regardless of the heavy defences, bombed it successfully. Displaying fine airmanship, he flew the aircraft to base and landed it safely.

Act. Sqn. Ldr. P. B. MOORE, D.F.C., No. 50 Sqn.—This flight commander is serving on his second tour of operational duty. He has taken part in attacks on some of the most important military targets in Germany, including both the "1,000" raids on Cologne and Bremen. He has attacked Hamburg twice, and on both occasions obtained an excellent photograph. Sqn. Ldr. Moore also led a flight of Lancasters on the very successful daylight raid on Le Creusot. In October, 1942, he was detailed to bomb Genoa and made a most determined attack. Two days later he participated in the daylight attack on Milan.

Flt. Lt. R. VAN DEN BOK, D.F.C., R.A.F.V.R., No. 408 (R.C.A.F.) Sqn.—In August, 1942, Flt. Lt. Van den Bok and Flt. Lt. Fisher were wireless operator/air gunner and navigator respectively of an aircraft detailed to attack Saar-

brucken. On the return flight the bomber was attacked by enemy aircraft, sustaining much damage. Flt. Lt. Van den Bok, who was wounded in the leg by a piece of shrapnel, and Flt. Lt. Fisher displayed outstanding courage, determination and fortitude. Both have completed many sorties.

F/O. E. R BUTLER, D.F.C., R.A.F.V.R., No. 97 Sqn.—As navigator, F/O. Butler has taken part in many successful sorties against the most heavily defended areas in Germany, including the daylight attack on Augsburg. Recently he participated in the daylight attacks on Le Creusot and Milan and a night attack on Genoa.

Act. Sqn. Ldr. R. D. YULE, D.F.C., No. 66 Sqn.—Since being awarded the D.F.C. in February this year, Sqn. Ldr. Yule has displayed untiring devotion to duty, fine fighting spirit and excellent leadership. He has participated in many operational sorties and in the combined operation at Dieppe. He has destroyed several enemy aircraft and damaged a number of others.

Act. Sqn. Ldr. J. R. PENNINGTON-LEGH, D.F.C., No. 175 Sqn.—Sqn. Ldr. Pennington-Legh has displayed exceptional leadership and high skill. This has been reflected in the successes achieved by his squadron in the destruction and damaging of enemy ships and aircraft.

Act. Flt. Lt. A. J. ANDREWS, D.F.C., R.A.F.V.R., No. 91 Sqn. (since missing).—Since being awarded the D.F.C., this officer has accomplished much excellent work. He has made nine attacks on enemy shipping, inflicting damage on each occasion. He has also destroyed one enemy aircraft.

DISTINGUISHED FLYING CROSS.

Act. Flt. Lt. G. C. FISHER, R.C.A.F., No. 408 (R.C.A.F.) Sqn.—For citation see Flt. Lt. Van den Bok, D.F.C.

Act. Flt. Lt. W. ABERCROMBY, No. 50 Sqn.—This officer has taken part in many operational sorties and has proved himself to be a thoroughly capable and reliable deputy flight commander. In July, 1942, he was detailed to attack Saarbrucken, and after carefully pin-pointing the target, he came down to below 5,000 feet and scored hits on the objective. Two nights later, when attacking Dusseldorf, his aircraft was caught in a cone of searchlights and attacked by a fighter. With great skill he so manœuvred his aircraft that his rear gunner was able to shoot down the attacker. In addition, Flt. Lt. Abercromby took part in the daylight raid on Le Creusot and one of the night raids on Genoa. In October, 1942, he flew one of the aircraft detailed to attack Milan in daylight. Although faced with serious opposition, he descended to within 100 feet before releasing his incendiaries on the target. His aircraft was hit many times and the rear gunner was mortally wounded. With superb airmanship Flt. Lt. Abercromby successfully extricated his badly damaged aircraft from the target area and flew it safely back to base.

F/O. G. F. B. NEWPORT-TINLEY, R.A.F.V.R., No. 138 Sqn.—One night in October, F/O. Newport-Tinley was captain of an aircraft and while flying at a height of 1,400 feet over the North French coast the aircraft was heavily fired on by anti-aircraft guns. He went on and successfully completed his task, but on the return journey the starboard engine caught fire. The fire was extinguished, but with only one engine working F/O. Newport-Tinley could not maintain height, and reached the English coast flying at only 80ft. in bad weather. Unable to clear the cliffs, by superlative airmanship he succeeded in bringing his aircraft down on to the sea without injury to his crew.

POWERLESS: Air Chief Marshal Sir Sholto Douglas, who has left Fighter Command to become A.O.C.-in-C. Middle East, tries his hand in a glider belonging to the A.T.C. gliding school at Harrow.

SERVICE AVIATION

Three Wounded

P/O. O. W. REES, R.A.F.V.R., No. 35 Sqn.—On night in October, 1942, P/O. Rees and Flt. Sgt. Stroud were captain and wireless operator/air gunner respectively of an aircraft detailed to attack Cologne. The target was bombed successfully and P/O. Rees continued his run in an endeavour to obtain a photograph. Whilst so doing, the aircraft was hit by anti-aircraft fire. Two engines were damaged and the turrets rendered unserviceable. Flt. Sgt. Stroud and two other members of the crew were wounded. By skilful airmanship P/O. Rees succeeded in evading the defences and headed for home. Meanwhile, the injured members of his crew were made as comfortable as possible. When an airfield in this country was reached, Flt. Sgt. Stroud, although in much pain, insisted on returning to his wireless set and, supported by the flight engineer, transmitted the necessary signals. In spite of difficulties, P/O. Rees landed his damaged aircraft safely.

Act. Flt. Lt. R. G. FOSKETT, R.A.A.F., No. 80 Sqn.—One day in November, 1942, this officer led his squadron in an attack on a formation of Stuka dive-bombers, heavily escorted by fighters. During the combat seven Stukas were shot down, a further eight probably destroyed, and several others were damaged. Flt. Lt. Foskett, who displayed great skill and daring, destroyed two of the enemy aircraft before his own was hit. He landed safely, however, and rejoined his squadron the same night. The following morning he resumed his flying duties.

Act. Flt. Lt. H. G. COLDBECK, R.N.Z.A.F., No. 69 Sqn.—This officer has performed outstanding work in Malta and the successes achieved against enemy shipping lately are largely due to his courage and skill in locating enemy convoys. On many occasions he has flown low over heavily defended areas and the resulting excellent information has been of invaluable assistance. On one occasion, although attacked by three enemy fighters, he flew over Palermo at 5,000 feet and located a large enemy tanker destined for North Africa.

P/O. F. M. FALLS, R.C.A.F., No. 97 Sqn.—As captain of aircraft, this officer has taken part in many attacks on the Ruhr and other targets in Germany, including a low-level attack on Danzig. Recently he participated in the daylight attacks on Le Creusot and Milan and one of the night attacks on Genoa.

P/O. G. E. FAWKE, R.A.F.V.R., No. 49 Sqn.—This officer has participated in many operational sorties and has brought back some excellent photographs. On one occasion he was detailed to make an attack on an important factory and although he had to descend to roof-top height to get below the cloud he successfully completed his task. P/O. Fawke took part in the daylight attack on Le Creusot and one of the night attacks on Genoa. He has shown a total disregard of the risks involved and a supreme determination to bring his mission to a successful conclusion, and has often secured valuable photographs of the target.

Two Engines Damaged

P/O. L. T. JACKSON, R.C.A.F., No. 83 Sqn.—One night in July, 1942, P/O. Jackson was pilot of a four-engined bomber detailed to attack the heavily defended town of Dusseldorf. While making his attack his aircraft was hit by anti-aircraft fire and severely damaged. The port and starboard outer engines were put out of action, but displaying expert airmanship P/O. Jackson manœuvred his aircraft away from the target area. On the return journey he lost height until he was down to 6,000 feet, when his aircraft was again engaged by searchlights and anti-aircraft fire, but by skilful evasive tactics he was able to continue on his course, and make a successful forced landing at his home base. Since this hazardous trip P/O. Jackson has taken part in many successful operations.

P/O. J. R. MCDONALD, R.C.A.F., No. 49 Sqn.—This officer has taken part in many operational sorties and on each occasion has successfully completed his mission. P/O. McDonald participated in the daylight attacks on Le Creusot and Milan and has made the extremely long flight to attack Genoa.

W/O. R. LEVER, No. 61 Sqn.—W/O. Lever has participated in many operational sorties over some of the most heavily defended areas in Germany. In October, 1942, he was captain of an aircraft forming part of the force which successfully attacked Le Creusot. He also captained aircraft which recently attacked Genoa and Milan.

Act. Sqn. Ldr. G. C. CAMPBELL, R.C.A.F., No. 420 (R.C.A.F.) Sqn.—This pilot has displayed great courage and resourcefulness on all his sorties, and sets a splendid example to the squadron by his cheerful readiness to accept any task, however arduous. He has participated in numerous attacks on important enemy targets and in mine-laying in enemy waters.

Act. Flt. Lt. R. M. PHILLIPPS, R.A.F.V.R., No. 103 Sqn.—This officer has shown a high degree of courage and determination to complete his allotted task. He has participated in sorties on many important enemy targets, including Brest, Kiel, Cologne and Dusseldorf. One night in November, 1941, Flt. Lt. Phillipps was the observer of an aircraft detailed to attack Hamburg. In spite of considerable physical suffering and lack of oxygen, he made great efforts to locate his objective but without success, as the aircraft compass was unservicable. Nevertheless, an alternative target was bombed and the aircraft safely navigated back to this country after a flight lasting 8½ hours. One night in January, 1942, he participated in a raid on the German naval base at Brest. In spite of unfavourable conditions and in the face of heavy opposition, Flt. Lt. Phillipps insisted on making four runs over the target.

Flt. Lt. R M D HALL, No. 91 Sqn.—This officer has completed a large number of sorties, including sweeps, shipping reconnaissances and many air/sea rescue operations.

Act. Flt. Lt. B. D. MURCHIE, R.C.A.F., No. 175 Sqn.—This officer has participated in numerous sorties, including many low level attacks on shipping and land targets. His keenness to engage the enemy has been outstanding and he has invariably pressed home his attacks with the utmost vigour.

F/O. G. E. JAMESON, R.N.Z.A.F., No. 125 Sqn.—This officer is a first-class pilot whose skill has enabled him to destroy two enemy aircraft at night. His keenness and devotion to duty have set a praiseworthy example.

Act. Flt. Lt. D. G. COLLINGE, R.A.F.V.R., No. 610 Sqn.—This officer has taken part in many operational sorties and shipping reconnaissances. At all times he has displayed great devotion to duty.

P/O. S. CLAYTON, D.F.M., No. 105 Sqn.—One day in October, 1942, this officer was the observer of an aircraft which attacked several targets in Germany in daylight. On the return flight, after crossing the enemy coast, the aircraft was attacked by two enemy fighters for some fifteen minutes. During the engagement P/O. Clayton's clear and concise directions to his pilot proved of the greatest assistance. By his skilful navigation in difficult circumstances this officer contributed materially to the success achieved.

Four Supply Ships

P/O. H. W. DONKERSLEY, R.C.A.F., No. 69 Sqn.—This officer has recently achieved much success against enemy shipping. One day in October, 1942, he attacked a tanker, inflicting severe damage. A few nights later he located and attacked a convoy of merchant ships escorted by several destroyers. After making his attack he returned to base, rearmed, and made a second attack. Early next morning reconnaissance aircraft carried out a search over a wide area in the vicinity of the attack and observed that three of the enemy ships were missing. Some nights later, P/O. Donkersley attacked one of two ships, escorted by destroyers setting the vessel on fire. Later it was learned that the ship had sunk. The success which attended his efforts deprived the enemy of much fuel so vital for the battle in Africa.

P/O. W. H. MATHEWS, R.C.A.F., No. 69 Sqn.—One day in October, 1942, this officer executed a successful attack on a large and heavily escorted merchant ship. Pressing home his attack with great skill, P/O. Mathews obtained a hit on the vessel, inflicting such damage that later it had to be run ashore and its cargo unloaded. His aircraft was damaged by anti-aircraft fire, but he flew it to base. On another night, towards the end of the month, P/O. Mathews attacked with telling effect another enemy merchant ship escorted by three destroyers. Later it was learned that the ship and its valuable cargo of fuel had become a total loss.

P/O. L. A. SMITH, R.A.F.V.R., No. 610 Sqn.—P/O. Smith has taken part in many attacks against targets in enemy-occupied territory and in shipping reconnaissances. He accomplished very good work during the combined operations at Dieppe on August 19th, 1942. This officer has destroyed two hostile aircraft.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. H. R. M. STROUD, No. 35 Sqn.—For citation see P/O. Rees.

Flt. Sgt. A. G. MCKENZIE, R.C.A.F., No. 50 Sqn.—Flt. Sgt. McKenzie has participated in many attacks on the enemy. As air bomber he has always shown great determination to press home his attack and hit the primary target. On many occasions excellent photographs have been obtained which reflect great credit to him. He took part in the daylight raids on Le Creusot and Milan and also in the night raid on Genoa on October 22nd, 1942. In the raid on Milan the aircraft flew at a very low altitude, and Flt. Sgt. McKenzie released his bombs, with unerring skill, in the middle of a large factory, which was left in flames.

Flt. Sgt. A. W. MORRIS, R.C.A.F., No. 50 Sqn.—This airman has taken part in many operational sorties. Flt. Sgt. Morris participated in the daylight raids on Le Creusot and Milan together and a very successful night raid on Genoa.

Sgt. W. BRAMWELL, No. 10 Sqn.—This airman was the rear gunner of an aircraft engaged on a sortie one night in September, 1942. On the return journey, whilst flying over the enemy coast, the aircraft was subjected to anti-aircraft fire from an armed ship. A large hole was torn in the fuselage and the inter-communication system rendered unserviceable. Consequently, Sgt. Bramwell, who had observed an enemy fighter within close range, was unable to warn his captain of the added danger. The fighter closed in and its pilot raked the fuselage and tail with gunfire. Despite this, Sgt. Bramwell delivered two accurate bursts, causing the attacker to break away and plunge towards the sea with its engines in flames.

Sgt. T. ST. L. BURR, No. 50 Sqn.—As wireless operator/air gunner Sgt. Burr has participated in

SERVICE AVIATION

a large number of operational sorties over Germany, many of which have been against the heavily defended north-western and Ruhr districts. He also took part in the very successful raids in daylight on Le Creusot and Milan and one of the night raids on Genoa. During the raid on Milan the aircraft was badly damaged and the rear gunner seriously wounded. Although at a low altitude Sgt. Burr was able to communicate with base and arranged for medical attention to be available on landing.

Sgt. R. G. HUTTON, No. 50 Sqn.—Throughout his operational career Sgt. Hutton has always shown exceptional keenness and has earned the full confidence of his pilot by his resourcefulness, efficiency and enthusiasm. He took part in the daylight attack on Milan when his aircraft was badly damaged and the rear gunner seriously wounded. Sgt. Hutton attended to his wounds expertly and had the duration of the flight been shorter it is very probable that his skilful first aid would have saved his comrade's life.

Ju 88 Shot Down

Sgt. N. F. WILLIAMS, R.A.A.F., No. 10 Sqn.—One night in September, 1942, this airman was the rear gunner of an aircraft which attacked Bremen. On the homeward flight, the aircraft was intercepted by a Ju 88 whose pilot manœuvred to attack from the rear. By his skilful evading directions, Sgt. Williams enabled his captain to keep the attacker at bay and, when the opportunity occurred, delivered a devastating burst which caused the enemy aircraft to burst into flames and dive steeply towards the ground.

Sgt. G. T. CHRETIEN, R.C.A.F. No. 405 (R.C.A.F.) Sqn.

Sgt. T. E. CARLON, R.C.A.F., No. 405 (R.C.A.F.) Sqn.—One night in October, 1942, Sgts. Chretien and Carlon were pilot and navigator respectively of an aircraft detailed to attack Kiel. Whilst over the target area, anti-aircraft fire was encountered, and Sgt. Chretien was wounded in the neck. Although bleeding profusely, he bravely remained at his post, ordered his bombs to be released, and skilfully piloted his aircraft from the fire zone. On the return, Sgt. Carlon, with great forethought, tended and assisted his wounded captain whilst skilfully navigating his aircraft on its course. When nearing base, Sgt. Chretien, who had been resting, resumed the controls, and, despite his injuries, succeeded in landing the aircraft safely.

Flt. Sgt. W. J. ROSE, No. 207 Sqn.

Sgt. R. S. WILSON, No. 207 Sqn.

Sgt. J. H. LOVELL, R.A.A.F., No. 207 Sqn.

Sgt. A. J. PERRIN, No. 207 Sqn.

Flt. Sgt. W. W. PECK, R.C.A.F., No. 207 Sqn.

As navigator, pilot, wireless operator/air gunners and rear gunner, respectively, these airmen flew in an aircraft which took part in an attack on Le Creusot on October 17, 1942. Shortly after taking off, engine trouble developed. Despite great efforts, Sgt. Wilson was unable to continue his mission, and course was set for base. Near to the French coast, whilst flying at only 40 feet above the sea, the aircraft was attacked by three enemy float planes. In the face of a trying situation Sgt. Wilson displayed fine airmanship, and, splendidly supported by his gunners, whose skill destroyed two of them and drove off the third, he eventually flew the aircraft back to an airfield in this country. During the combat, Flt. Sgt. Rose coolly continued his duties and his subsequent navigation was of the greatest assistance to his pilot.

Ship Destroyed

Sgt. G. BUCHANAN, No. 38 Sqn.—In October, 1942, Sgt. Buchanan was captain of an aircraft detailed to attack a large enemy merchant vessel. Despite the protection of two escorting destroyers, Sgt. Buchanan persisted in his attack and destroyed the ship. On two other occasions this airman has made successful attacks on enemy supply ships.

Flt. Sgt. J. GOLDIE, No. 97 Sqn.—Flt. Sgt. Goldie has taken part in many attacks against the most heavily defended targets in Germany, including a low-level attack in daylight on Danzig and the highly successful "1,000 raid" on Cologne. He has recently participated in the daylight attacks on Le Creusot and Milan and one of the night attacks on Genoa.

Flt. Sgt. W. H. KEANE, R.C.A.F., No. 97 Sqn.—This airman has taken part in many attacks against the most heavily defended targets in Germany, including the low-level attack on Augsburg and the "1,000 raid" on Cologne. Recently he has participated in the daylight attacks on Le Creusot and Milan and one of the night attacks on Genoa.

Sgt. G. CRUICKSHANK, No. 50 Sqn.—Sgt. Cruickshanks, as rear gunner, has taken part in many successful operational sorties. During the fiercest opposition he has remained unflurried, and by his quiet efficiency and vigilant lookout has materially assisted his pilot. He participated in the raids on Rostock and in one of the recent attacks on Milan.

Sgt. A. MEAGHER, No. 61 Sqn.—As captain of aircraft Sgt. Meagher took part in the daylight attacks on Le Creusot and Milan, and one of the night attacks on Genoa. On each occasion he completed his mission successfully and obtained excellent photographs. He has participated in many operational sorties.

Sgt. C. H. WATT, R.A.A.F., No. 44 Sqn.—On October 24th, 1942, Sgt. Watt was pilot of an aircraft forming part of a formation detailed to attack Milan in daylight. On the journey out a starboard engine failed, but Sgt. Watt flew a further 150 miles to reach his target and successfully bombed his objective. He accomplished the arduous task of recrossing the Alps and returning to base on three engines, making a perfect landing. This airman has taken part in many operational sorties.

Flt. Sgt. (now P/O.) R. J. A. WHEATLEY, R.C.A.F., No. 207 Sqn.—Flt. Sgt. Wheatley has at all times displayed exceptional keenness on operational flying and a great determination to locate and bomb the primary target, regardless of adverse weather or enemy opposition. His skilful navigation and complete disregard of danger have contributed considerably towards the successes achieved.

Sgt. (now P/O.) C. R. G. GRANT, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Sgt. Grant has taken part in night operations over enemy territory, displaying consistent skill and determination. This airman's quiet courage and exceptional leadership have been an inspiration to his squadron.

Sgt. D. C. HEDLEY, R.A.F.V.R., No. 83 Sqn.—As a pilot this airman has taken part in five raids on Hamburg, two on Kiel and one on Berlin. He has also participated in an intruder patrol when he descended to 500 feet and spent over 75 minutes in the area, machine-gunning searchlight concentrations. On one occasion Sgt. Hedley made a successful forced landing after returning from an operation and flying for an hour on one engine.

Sgt. (now P/O.) H. H. SANDFORD, No. 35 Sqn.—Sgt. Sandford has consistently given excellent service, over a long period, as a navigator, and throughout has shown great devotion to duty, and determination to press home the attack whatever difficulties or dangers have to be faced. He has participated in attacks on some of the enemy's most heavily defended targets, and his skill as bomb-aimer, coupled with extreme coolness and disregard of danger when under fire, has largely contributed to the successes achieved by his crew.

Flt. Sgt. F. E. GATLAND, R.N.Z.A.F., No. 214 Sqn.—One night in October, 1942, Flt. Sgt. Gatland was captain of an aircraft detailed to attack a target at Genoa. Heavy cloud obscured the target but despite this and opposing fire from the ground defences, Flt. Sgt. Gatland courageously pressed home his attack from a low level while his gunners engaged the searchlights and gun emplacements.

THE KING has been graciously pleased to approve the following awards:—

GEORGE MEDAL.

F/O. J. A. ELLIOTT, M.R.C.S., L.R.C.P., R.A.F.V.R.—In May, 1942, a Boston aircraft crashed shortly after taking off from an airfield, and burst into flames. An airman who was on duty near by hastened to the scene where he was joined by five soldiers. Although the fire was intense and ammunition was exploding in all directions one member of the crew (the air gunner, who was seen to be hanging out of the turret) was dragged from the wreckage by one of the soldiers, and then, with the assistance of the remainder of the party, carried on a stretcher to an ambulance which had arrived. The party was returning to the aircraft, which was then being approached by the station engineer officer and F/O. Elliott, a medical officer, when a bomb exploded. The engineer officer was thrown to the ground bleeding from the chest.

F/O. Elliott, although also knocked down, was uninjured and immediately went to the aid of the engineer officer. He gave him morphia and at the time was fully aware that other bombs were in the aircraft only eight yards away. A second bomb exploded which wounded F/O. Elliott, but he valiantly attempted to remove his injured comrade. Eventually F/O. Elliott was assisted away by one of the soldiers, whilst the remaining men of the party removed the engineer officer, who was found to be dead.

Roll of Honour

Casualty Communiqué No. 131.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. G. C. Bunning; P/O. H. Dent; P/O. S. S. Dimond; P/O. W. A. Fullerton, D.F.M.; Sgt. P. G. McGrath; Sgt. J. W. Mortimer; Sgt. J. H. Munday; Flt. Sgt. J. K. Napier, D.F.M.; P/O. R. J. Purser; Sgt. R. H. M. Sanders; F/O. L. J. Tait.

WOUNDED OR INJURED IN ACTION.—Sgt. V. N. Baker; Sgt. J. Douglas; Sgt. K. E. Wakley.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. E. C. Allen; Sgt. R. H. Ashwell; Sgt. J. C. Bellinger; Sgt. T. Bickers; Sgt. F. Birch; Sgt. T. McC. Campbell; Sgt. E. C. A. Coules; Sgt. E. J. Cutting; Act. Flt. Lt. R. H. L. Dawson; Sgt. G. Hebblethwaite; Flt. Sgt. J. Jack; Sgt. A. E. Johnson; P/O. J. Leewarden; P/O. D. H. MacNaughton; Sgt. K. E. M. Mitchell; Sgt. W. C. Meachon; Sgt. A. Norton; P/O. A. H. Paget; Sgt. M. Rowbottom; Flt. Sgt. M. G. Savage; Sgt. F. V. H. Shepherd; Sgt. H. R. Skinner; Flt. Sgt. G. C. W. Stone; Sgt. E. Tupholme; Wing Cdr. A. P. Walsh, D.F.C., A.F.C.; Sgt. S. A. Wills; Sgt. H. V. Winch.

MISSING.—A/C.1 N. J. Alecock; Sgt. H. Allen; Sgt. W. Anderson; Sgt. E. H. Beyer; Sgt. A. C. Blogg; Sgt. D. M. Bowd; Sgt. W. J. Bushell; Flt. Sgt. R. A. Colehan; Flt. Sgt. F. J. Craven; Flt. Lt. G. N. Dawson; Sgt. A. F. Ellis; Sgt. E. G. Follett; Sgt. C. W. Free; Sgt. R. A. Garner; Sgt. R. Gibson; Flt. Lt. W. Gilmour; Sgt. H. E. Goldie; P/O. P. A. L. Gomperts; Sgt. R. W. Harding; P/O. J. H. Harrad; Sgt. C. E. Hayward; F/O. A. R. Hill; Sgt. D. F. J. Hinde; Sgt. E. A. Hooker; Sgt. E. R. Hunting; Sgt. F. L. James; Flt. Lt. D. N. Kennedy; Sgt. D. King; Sgt. J. King; Flt. Sgt. S. King; P/O. F. A. J. Laidlaw; Sgt. R. H. Linton; Sgt. J. B. Llewelyn Roberts; P/O. J. W. Longhurst; Sgt. C. Lyle; Sgt. J. M. McNeary; Sgt. G. A. Melville; P/O. N. Millidge; Flt. Sgt. F. J. Monk; Sgt. T. C. B. Murlis; Flt. Sgt. J. Myers; Sgt. K. Norgate; Sgt. F. Rawson; Sgt. J. E. Richards; A/C.1 E. D. R. Senior; F/O. A. R. Stone; Act. Flt. Lt. A. C. Spencer, D.F.M.; P/O. W. D. Taylor; Sgt. E. W. Temple; Sgt. W. Toole; Sgt. A. W. Utting; Sgt. A. Waterworth; Sgt. J. I. White; Sgt. R. P. Williams; Sgt. P. S. Woolston.

KILLED ON ACTIVE SERVICE.—Sgt. H. B. Burnett; Sgt. A. Dougherty; Sgt. J. D. Duffus; Sgt. R. Gasken; Sgt. C. D. Hammond; Wing Cdr. R. B. Harvey; Flt. Sgt. R. J. Hayes; P/O. W. R. Stephens; Sgt. G. Thornhill; Sgt. R. G. Wraight.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. J. E. Burrell; Sgt. G. W. Hall; A/C.1 L. Wrigley.

DIED ON ACTIVE SERVICE.—L.A/C. H. L. P. Boxer; A/C.2 H. J. Foster; A/C.2 T. N. Jasper; L.A/C. L. A. Songest; A/C.2 L. W. Topham; Cpl. T. W. Watts.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. A. W. T. Lancaster; Sgt. V. Murray; Cpl. F. Robertson; Cpl. J. Rooney; P/O. G. H. Whyte; P/O. W. H. Young.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. P. W. Hearne; Sgt. F. G. Potter.

WOUNDED OR INJURED IN ACTION.—Sgt. R. N.

South African airmen trainees loading a torpedo into a Bristol Beaufort at a Royal Naval Torpedo School where they are taking a course.

SERVICE AVIATION

Ey; Sgt. H. R. Hannaford; Sgt. J. Roach; Sgt. W. W. Thomas.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. R. Cummins; Sgt. J. E. Dalton.

MISSING.—Sgt. M. S. Brighouse; Sgt. R. V. Chinnery; P/O. A. H. Comber; F/O. L. G. Emrys-Jones; Sgt. E. R. Eva; P/O. R. H. H. Hosband; P/O. L. G. Lyons; P/O. D. I. Stewart; Sgt. V. J. Watson; P/O. O. L. Wennholm; Sgt. P. R. A. S. Whiting; Sgt. A. Wotherspoon.

KILLED ON ACTIVE SERVICE.—F/O. J. Callahan; F/O. J. H. Rowe; Sgt. D. H. Steele.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. F. W. Beste; Sgt. J. S. Cameron; Sgt. A. R. Tonkin.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. J. S. M. M. Bernier; Sgt. W. A. Hayes; Sgt. M. E. Shaw.

WOUNDED OR INJURED IN ACTION.—P/O. G. F. Newton; Flt. Sgt. A. G. Markle; Sgt. MacA. Powers.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. W. Cassidy; Sgt. A. E. Caton; Sgt. A. F. Christie; Sgt. A. C. Ewing; P/O. J. N. Freestone; P/O. G. B. Hart; Act. Flt. Lt. L. D. Hillier; Sgt. A. Holmes; Sgt. B. A. McGrath; Sgt. V. H. Miller; Sgt. J. R. Morrow; Sgt. A. D. Muir; P/O. F. R. Pye; Sgt. G. W. Roberts; P/O. H. W. Thompson; Sgt. P. K. Zaparynuk.

MISSING.—Sgt. S. P. Banks; W/O. C. A. Beath; W/O. B. Butler; Sgt. C. N. Chalklen; Sgt. L. M. Cowan; P/O. J. E. Gardiner; Flt. Sgt. L. L. Garner; Sgt. R. R. Gray; Flt. Sgt. K. R. Jackson; Flt. Sgt. F. Janiszewski; Flt. Sgt. J. Jemmett; P/O. J. E. Loree; Sgt. R. H. Lyons; Sgt. G. McArter; P/O. J. E. Madson; P/O. A. Monchier; P/O. C. W. Pafford; P/O. W. S. Pattinson; P/O. K. T. Pellett; Flt. Sgt. E. E. Sheppard; Sgt. A. Shepherd; Sgt. C. P. Shriner; W/O. G. H. Smith; Sgt. C. A. L. Sutherby; P/O. L. A. Walker; P/O. T. L. Wilson; Sgt. G. D. Woolrich; P/O. J. A. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. G. Pellettier.

KILLED ON ACTIVE SERVICE.—Sgt. J. Anderson; Sgt. J. L. Brovender; Sgt. G. E. Darbyshire; Sgt. B. D. Francis; Sgt. J. B. Hargreaves; Sgt. R. H. Harper; Sgt. L. L. Jones; P/O. K. G. Lavery; Sgt. A. Leether; Sgt. R. A. E. Lutes; Flt. Sgt. J. L. O. Primeau; Sgt. W. B. Sage; P/O. G. L. Shaw; Sgt. E. T. Spears; P/O. E. F. J. Stoll.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. D. F. Foy; Sgt. R. G. Walters.

DIED ON ACTIVE SERVICE.—A/C.1 A. L. McConnell.

Royal New Zealand Air Force

WOUNDED OR INJURED IN ACTION.—Sgt. T. Thomson.

MISSING, BELIEVED KILLED IN ACTION.—P/O. P. P. Hayes; Sgt. G. E. Reid; Flt. Sgt. K. F. Ryan; F/O. R. H. Suckling.

MISSING.—Sgt. T. L. Boland; P/O. R. W. Byers; P/O. R. H. Dunckley; P/O. W. H. Gould; Flt. Sgt. O. Haynes; Sgt. C. L. Parker; Sgt. P. Scullin; Sgt. J. W. Stuart.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. Wilding.

DIED ON ACTIVE SERVICE.—Sgt. T. B. Burrows.

South African Air Force

KILLED IN ACTION.—Lt. J. A. Kourie; Maj. E. Smith.

WOUNDED OR INJURED IN ACTION.—Lt. H. E. Kirby; Lt. A. W. Meikle; Lt. W. B. Pearse; 2/Lt. M. Rabie; Lt. H. Stearn; Lt. D. D. Stuart; Lt. A. D. Swart.

MISSING, BELIEVED KILLED IN ACTION.—2/Lt. D. De Lkerk.

MISSING.—Air Sgt. C. Berkowitz; Air Sgt. B. Katz; Lt. R. E. Nissen; Lt. J. A. Pocock.

Casualty Communiqué No. 182

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. V. E. Ames; Flt. Sgt. H. E. Bannister; Flt. Sgt. K. P. Barber; Sgt. H. W. Batty; Sgt. G. W. Brewster; Sgt. C. F. Castle; Sgt. H. G. Challicombe; Sgt. E. Cowan; L.A/C. W. Currie; Sgt. R. W. Freeman; Sgt. L. G. Harvey; Sgt. W. H. Henderson; P/O. C. W. Higgins; Sgt. G. T. Lapping; Sgt. H. H. Maginn; Sgt H. G. Mallot; Sgt. S. Mansfield; Sgt. J. T. Murray; P/O. A. S. Needham; Sgt. J. E. Nicholson; Sgt. W. E. Pittendrigh; Sgt. N. A. Prime; Sgt. A. S. Renwick; P/O. A. Robson; Sgt. A. Rogers; Sgt. C. R. Rundle; Sgt. F. Smith; Sgt. H. L. Stevens; Act. Flt. Lt. J. A. Sword, D.F.C.; Flt. Sgt. A. N. Thompson; Sgt. F. A. Thorpe; Sgt. K. H. Vigers; Sgt. H. E. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. N. Clare; P/O. J. T. B. Clough; Sgt. A. J. De Cann; Sgt. B. J. Dykes; P/O. J. R. Feirn; A/C.1 E. Hopkinson; P/O. R. H. Jacobs; Sgt. G. W. E. Jacobson; F/O. G. R. Jenkins; Flt. Sgt. H. Jones; Act. F/O. H. Kitchin; Sgt. D. McLellan; W/O. H. S. Mason; Sgt. K. C. Nutt; P/O. M. L. Pearson; Sgt. A. A. Rolfe; Flt. Sgt. J. F. C. Smith; Sgt. J. A. Steele; Sgt. J. A. Woodroffe; Flt. Lt. F. W. Smith.

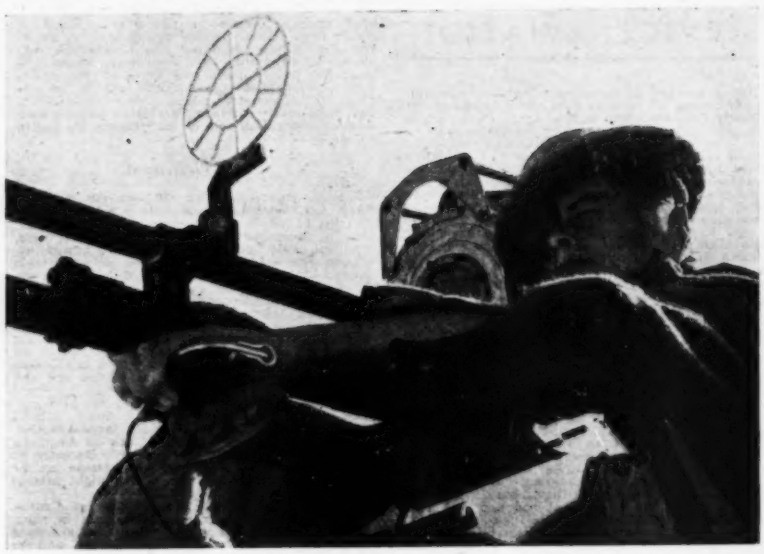
WOUNDED OR INJURED IN ACTION.—Sgt. D. Anderson; P/O. E. H. Bicknler; Sgt. F. S. Conway; Sgt. F. J. Evans; Flt. Sgt. H. Kitto; P/O. H. Lowe; P/O. J. C. E. MacDonald; Sgt. T. C. B. Smith; Flt. Sgt. W. H. Throup.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. T. Bryan; Sgt. R. G. Wheale.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. S. Bland; Sgt. W. S. Collins; Sgt. J. Coyne; P/O. E. F. Dowdell; Sgt. J. H. Garland; Sgt. H. Gregson; P/O. S. Howlett; Sgt. P. K. Jones; P/O. R. G. Lewis; Flt. Sgt. W. H. McAlwane; Sgt. R. L. Moss; Sgt. A. F. Potts; Sgt. F. Roberts; Flt. Sgt. R. Robertson; P/O. J. M. B. Scott; Sgt. T. B. Treble; Sgt. G. A. Walker; Sgt. J. McR. Wallace; Sgt. E. J. Stansfield.

MISSING.—Sgt. R. Ainsworth; Flt. Sgt J. A. G. Anscomb; Sgt. R. J. Bebbington; Sgt. S. J. Berry; P/O. R. A. Bingham; Flt. Lt. R. M. Buchan, D.F.C.; Sgt. A. Calvert; Sgt. W. D. Carrick; Sgt. R. C. F. Charlton; Sgt. S. F. Clark; Flt. Lt. A. F. A. Osborn, D.F.C.; Sgt. A. G. Cook; Sgt. S. Coop; Sgt. W. H. Creed; Sgt. E. R. Cox; Sgt. W. Davies; Sgt. J. P. Deaton; Sgt. K. J. P. Duncan; Sgt. J. Ferguson; Sgt. J. E. Galton; P/O. N. I. Gill; Sgt. J. Glaves; Sgt. T. J. Harboard; F/O. E. J. Harris; P/O. R. W. Harrison; P/O. J. W. Hawkes; P/O. P. W. Hewitt; Sgt. W. J. Hilton; Sgt. S. H. Jackson; P/O. F. G. R. Jeffries; Sgt. A. H. Jennings; P/O. G. E. Johns; Sgt. P. Johnson; P/O. J. C. Kenworthy; Sgt. T. Kirkham; Sgt. W. Law; Sgt. S. Lloyd; L.A/C. H. W. Long; Flt. Sgt. J. McCormack; Sgt. R. McGregor; Flt. Lt. E. P. F. L. T. Magruder; Sgt. K. Marshall; Sgt. C. S. Maxfield; Sgt. G. G. Millard; Sgt. R. Moore; Sgt. W. Moylan; Sgt. E. V. Norman; Sgt. E. O'Hara; Sgt. W. E. Overend; Sgt. J. Patch; Flt. Sgt. J. W. Pilling; P/O. J. G. Pope; P/O. G. H. Quinn; Sgt. H. D. Quintrell; Sgt. H. A. Roberts; Flt. Sgt. T. Rooney; Sgt. J. A. Rowley; Sgt. P. W. A. Samwell; Sgt. D. R. W. Scholfield; Sgt. J. F. Sears; Sgt. K. Seddon; Sgt. L. A. Shepherd; Sgt. J. M. Sloan; Sgt. E. I. Sofaer; L.A/C. P. Squires; Sgt. A. D. Smith; F/O. B. G. H. Smith; F/O. I. N. Stein; Sgt. L. M. Tetley; Sgt. F. R. Thomas; Sgt. A. G. Tillett; Sgt. J. W. Todd; Sgt. R. Turley; Sgt. D. W. Wallis; Sgt. S. A. Webster; Sgt. R. G. West; Flt. Sgt. J. C. Wilkinson; Sgt. J. Williams; P/O. F. P. Winter-Taylor; Sgt. F. Wood; Sgt. H. Wright.

KILLED ON ACTIVE SERVICE.—Sgt. G. H. Bennett; Sgt. D. P. Broomfield; A/C.2 W. D. Capaldi; Sgt. W. F. Carey; Sgt. L. H. Davies; Sgt. D. C. A. P. R. Denville; P/O. P. W. Dorman; Sgt. D. A. Green; P/O. E. L. Hall; Sgt. M. R. Haworth; Sgt. W. A. Howell; L.A/C. V. J. Jeffery; P/O. W. H. McCormack; Sgt. T. L. Morgan; A/C.2 R. N. Noe; F/O. K. J. Rich; Sgt. E. J. Ridgewell; Sgt. H. Sherwood; Sgt. E. H. Studholme; L.A/C. J. R. Thompson; A/C.2 H. A. Tilcock; Sgt. R. V. Turpitt; Sgt. A. S. White.



A gunner of the R.A.F. Regiment in the Middle East at the sights of his dual-purpose anti-aircraft anti-tank weapon.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Lt. T. V. G. Banks; P/O. J. Gwyther; L.A/C. J. L. Howard; A/C.2 A. G. Knight.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. R. F. J. Lane; Sgt. H. Paul.

DIED ON ACTIVE SERVICE.—Act. Flt. Lt. W. A. Brown; L.A/C. S. C. Elsey; A/C.2 R. E. Holmes; Flt. Sgt. F. Jowett; Cpl. D. Reid; Act. Cpl. T. A. Watts; L.A/C. F. T. Wilkinson; A/C.1 W. Wolstencroft.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. J. R. Kay; P/O. G. Richards; Sgt. E. Sarene; P/O. D. P. Williams.

Royal Australian Air Force

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. J. N. Barker; Sgt. W. W. Jarrett; Sgt. C. H. M. Smith; Sgt. H. T. A. Turner; Sgt. C. C. Viney.

MISSING.—F/O. H. L. Mazengarb; Sgt. C. H. Thompson.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. W. T. Crabb; F/O. F. J. Fife.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. A. Jackson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. I. Fairley; Sgt. H. T. McGrath; P/O. N. N. Powell.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. H. J. Boucher; Sgt. F. A. Larsen.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. J. W. Adams; Sgt. C. S. Elkington; P/O. P. A. V. England; Sgt. R. W. L. Mills.

MISSING.—Sgt. B. S. Biden; Flt. Sgt. D. J. Calderwood; Flt. Sgt. L. G. Chaston; Sgt. G. F. Fargher; P/O. R. H. Frame; Sgt. J. D. Gill; Sgt. C. H. Hincks; Sgt. J. F. Irvine; P/O. M. F. Johnson; F/O. J. G. McDonald; Flt. Sgt. G. L. McKenna; Flt. Sgt. E. M. Palmer; P/O. W. I. Quinn; Sgt. J. N. Tapp; W/O. R. L. Telfer; Sgt. H. R. Watson.

KILLED ON ACTIVE SERVICE.—Sgt. D. M. Gilmour; Sgt. F. E. Meers; Sgt. J. A. Montgomery; Sgt. H. B. Shaver; Sgt. F. H. Wright.

Royal New Zealand Air Force

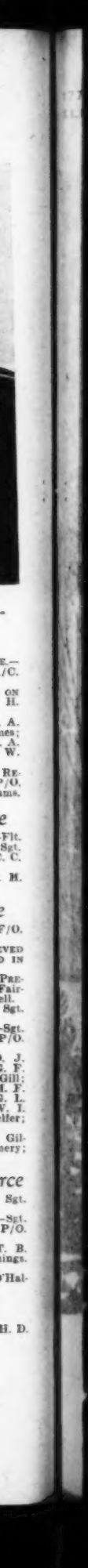
KILLED IN ACTION.—Sgt. T. F. Munro; Sgt. J. F. Stanley.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. E. Martin; Sgt. R. F. Swindlehurst; P/O. P. A. Vivian.

MISSING.—Sgt. F. B. Boaden; P/O. E. T. B. Dalzell; Sgt. D. P. Hogan; Sgt. G. S. Jennings. Sgt. V. A. Tunbridge; Sgt. K. J. Warner.

KILLED ON ACTIVE SERVICE.—Sgt. C. A. O'Halloran; Sgt. E. D. Sale.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Lt. E. H. D. Carman; Lt. A. C. Joubert.

MISSING.—Lt. C. Evans.